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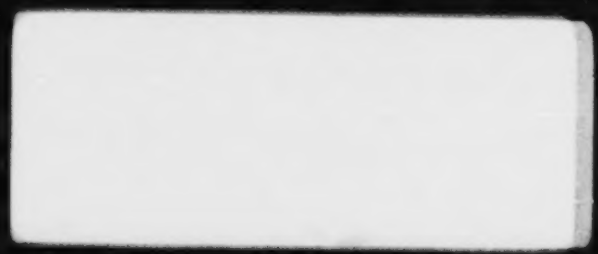

Direction générale des eaux intérieures et des terres

Région de l'Ontario

Canada

Report on Results of the Hydrometric Data User Questionnaire Survey For Ontario

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ABSTRACT

A questionnaire survey was carried out of users of hydrometric data of Ontario in order to obtain detailed feedback information regarding the hydrometric data network. The survey was co-ordinated by the Network Evaluation and Planning Sub-Committee (NEPS) of the Coordinating Committee of the Canada/Ontario Cost Sharing Agreement for Water Quantity Surveys. The Water Resources Branch of Environment Canada served as the lead agency working together with representatives of the Ontario Ministry of Natural Resources, Ministry of Environment and Ontario Hydro.

A four page questionnaire with a one page map of Ontario watersheds was sent to 367 data users in October, 1986. The questionnaire was designed to obtain feedback information from data users on their present and future requirements for hydrometric data. By December 31, 1986, 205 questionnaire responses were received.

The questionnaire responses gave a good representation from four user groups: Federal, Provincial, Consultants and Other (including users from educational institutions and private individuals/companies). A response rate of approximately 60 percent was obtained from each of the user groups. Extensive comments were provided by many users. The questionnaire response information was analyzed according to twelve question blocks from the questionnaire.

The results of the survey lead to several conclusions regarding: the extensive variation in the feedback information, the suitability of data being collected and archived, the increasing need for data experienced by most data users, and the many different applications of Ontario hydrometric data. Many users indicated that more data is needed in Northern Ontario, small watersheds throughout the Province and urban watersheds. Recommendations were made concerning network modifications, data analysis and provision by the agencies collecting the data and concerning future contacts with data users/clients.

RESUME

Nous avons effectué un sondage auprès des utilisateurs de données hydrométriques en Ontario afin d'obtenir des information détaillées sur le réseau des données hydrométriques. La coordination du sondage a été confiée au Sous-comité de l'évaluation et de la planification du réseau qui relève du Comité de coordination de l'Accord Canada/Ontario sur le partage des coûts relatifs aux enquêtes quantitatives sur l'eau. C'est la Direction des ressources en eau d'Environnement Canada qui a dirigé l'opération en collaboration avec des représentants du ministère des Richesses naturelles de l'Ontario, du ministère de l'Environnement de l'Ontario et d'Ontario Hydro.

En Octovre 1986, on a envoué à 367 usagers un questionnaire de quatre pages accompagné d'une carte des bassins hydrographiques de l'Ontario. Par ce questionnaire, on cherchait à obtenir de l'information sur les besoins présents et future des usagers en matière de données hydrométriques. Au 31 décembre 1986, on avait reçu 205 questionnaires.

Les réponses étaient très représentatives des quatre groupes d'usagers suivants: secteur fédéral, secteur provincial, experts-conseils et autres usagers (notament établissements d'enseignement et particuliers ou compagnies privées). Le taux de réponse s'est élevé à environ 60 pour 100 dans chacun des groupes. De nombreux usagers ont fourni des commentaires très détaillés. On a découpé le questionnaire en douze sections pour analyser les réponses.

Les résultats de l'enquête ont abouti à plusieurs conclusions, à savoir la très grande variation de l'information que nous avons reçue, la pertinence des données recueillies et archivées, le besoin croissant en données que connaissent la plupart des usagers, et, enfin, la très grande diversité des applications des données hydrométriques de l'Ontario. De nombreux usagers ont indiqué qu'il faudrait plus de données touchant le nord de l'Ontario, les petits bassins de toute la province et les bassins urbains. On a fait des recommandations concernant les modifications à apporter au réseau, l'analyse des données et leur fourniture par les organismes qui les recuillent, et les contacts à établir avec les usagers des données et les clients.

(Disponible en français sur demande)

TABLE OF CONTENTS

		Page
	ABSTRACT	ii
	Table of Contents	iii
	List of Figures	iv
	List of Tables	v
1.	INTRODUCTION	1
2.	DESIGN OF THE DATA USER QUESTIONNAIRE	3
3.	DATA BASE OF HYDROMETRIC DATA USERS	7
	3.1 Selection of the Mailing List of Data Users	7
	3.2 Data Users Responding to the Questionnaire	9
4.	QUESTIONNAIRE RESPONSE INFORMATION	12
	4.1 User Identification	13
	4.2 Type of Water Resources Activity	14
	4.3 Water Resources Projects/Studies	17
	4.4 Types of Data Used	19
	4.5 Provision of Data to the Users	22
	4.6 Changing Data Needs	25
	4.7 Data Analyses by the Users	29
	4.8 Data Interpretation Suggestions	33
	4.9 Data Requirements in the Existing Network	36
	4.10 Areas of Ontario with Insufficient Data	38
	4.11 Comments/Suggestions	40
	4.12 Responses to Map of Ontario Watersheds	42
5.	GENERAL OBSERVATIONS	45
6.	CONCLUSIONS	48
	6.1 User Profile Information	48
	6.2 Data Uses, Types and Provision	49
	6.3 Network Requirements	51
7.	RECOMMENDATIONS	53
	7.1 Data User/Client Contacts	53
	7.2 Data Analysis and Provision	53
	7.3 Network Modifications	54
	References	56
	Appendix A: Example Data User Questionnaire	
	Appendix B: Mailing List of Hydrometric Data Users	
	Appendix C: List of Data Users Responding to Questionnaire	

LIST OF FIGURES

		Page
1.	Map of Major Watersheds in Ontario.	6
2.	Pie Chart of Number of Questionnaires Mailed	11
3.	Pie Chart of Number of Questionnaire Responses	11
4.	Types of Water Resources Activity Indicated by Hydrometric Data Users	16
5.	Hydrometric Data User Questionnaire: Types of Data Used	21
6.	Pie Chart of Changing Data Requirements	28
7.	Responses to Map of Ontario Re: Watersheds Where Data Required	44
8.	Number of Responses for all Question Blocks	47

LIST OF TABLES

		Page
1.	Question Blocks of the Questionnaire Survey	5
2.	Listing of Companies/Agencies on User Mailing List. Listed by User Group (Total number of users in brackets).	10
3.	List of Topics Included in Responses to: WATER RESOURCES PROJECTS/STUDIES.	18
4.	Responses to Provision of Data Within Certain Time Frame	22
5.	Comments provided on suggestions for improving service of provision of data to users.	24
6.	Types of Data Analysis Carried Out by the Users.	29
7.	Additional Types of Analyses Carried Out by the Users	31
8.	Number of responses for "Other" types of data.	31
9.	Other types of data used in projects involving streamflow data (Comments provided by Users).	32
10.	Suggestions for Data Analyses by Data Agencies.	33
11.	"Other" suggestions for Data analyses by the Data Agencies.	34
12.	Users responding to question regarding critical needs for data.	36
13.	Total responses grouped by Ontario Watersheds.	42

1. INTRODUCTION

Many hundreds of people utilize Ontario hydrometric data in water related projects and studies. Hydrometric data is collected through a Federal-Provincial Agreement, the Canada/Ontario Cost Sharing Agreement for Water Quantity Surveys. The Water Resources Branch of Environment Canada in Ontario Region (WRB-OR) and three agencies of the Province of Ontario (Ministry of Natural Resources (OMNR), Ministry of Environment (OMOE), and Ontario Hydro (OH)) coordinate the data collection program. Environment Canada is the primary agency for collection, processing, archiving and dissemination of the data. Hydrometric data is available on request at no charge to the public.

The Cost Sharing Agreement is administered by a Coordinating Committee which is made up of appointed members from the participating agencies. The Network Evaluation and Planning Sub-Committee (NEPS) reports to this Coordinating Committee. NEPS activities include the co-ordination of activities and exchange of information in the areas of network analysis and planning. The questionnaire survey of hydrometric data users in Ontario described in this report was co-ordinated by NEPS.

Gaining an improved knowledge of the requirements and views of the data users is an important step in the process of network evaluation. Discussions were held at the meeting of the NEPS in November 1985 regarding a survey of hydrometric data users by questionnaire. The objectives of such a survey were to obtain valuable information from the users such as feedback information regarding data requirements, changing needs, and comments on various aspects of the hydrometric program including provision of data to users. The survey would provide the users with an opportunity to have input to the network evaluation and planning process. In addition the survey would also inform the users of the activities of the cost-sharing agencies and in particular make the users aware of the increased effort by the data collection agencies in the area of network evaluation and planning.

The Water Resources Branch of Environment Canada (WRB-OR) served as lead agency in the questionnaire survey. This report describes the questionnaire survey project as carried out by WRB-OR. Chapter two presents a summary of

the design and development of the questionnaire. The next phase, which is presented in Chapter three, was the selection of users to be contacted. Chapter three also describes the Data Base of Hydrometric Data Users. The questionnaires were mailed in October 1986 and returns were monitored through to December 31, 1986. Chapter four presents the questionnaire response information which was summarized and analyzed according to the twelve blocks or groups of questions on the questionnaire. Chapter five presents some overall observations made from the response information and general implementation of the questionnaire survey. Chapter six provides conclusions from the survey of hydrometric data users and chapter seven provides recommendations for the hydrometric program based on results of the survey.

2. DESIGN OF THE DATA USER QUESTIONNAIRE

An initial step in the design of the questionnaire was to obtain and review example questionnaires carried out by other agencies. Some of the example questionnaires obtained were used for purposes other than a survey of hydrometric data users. The examples reviewed are included in the list of references of this report. Some individuals who were involved in carrying out these other questionnaire surveys were contacted in order to obtain insights from their experiences. This effort provided interesting and stimulating ideas for inclusion in the Ontario survey.

Several general methods were available for this project such as: a written questionnaire mailed to data users, personal or telephone interviews with users, a limited survey to selected representative users, a survey to most known users, an intensive survey with many detailed questions, or a very brief multiple choice type questionnaire. The NEPS representatives discussed the various approaches and selected the option of a moderately detailed written questionnaire survey sent via mail to most known users of Ontario hydrometric data. It was estimated that the mailing list would include approximately 300 data users in Ontario.

A draft user questionnaire was developed and tabled at the May 26, 1986 meeting of NEPS. The draft questionnaire was reviewed by NEPS members and other staff of the agencies involved and comments were provided to WRB-OR. The final questionnaire was prepared in September 1986. A copy of the questionnaire is in Appendix A.

The structure of the questionnaire is outlined in Table 1. There are twelve blocks (or groups) of questions and each block addresses a different aspect the present or future use of Ontario hydrometric data. It was felt that this structure would help each data user prepare his/her response and would facilitate a systematic analysis of all the responses.

The twelve blocks of questions cover three areas of interest which are: a) user profile information, b) feedback from the data users regarding types of data collected, provision of data, and applications of data and c) feedback from the users on the spatial characteristics of the network. These three areas are indicated in Table 1 together with the listing of question blocks to show the general structure of the questionnaire.

The questionnaire is five pages in length including the one-page map attachment (Figure 1). Throughout the questionnaire questions and answer spaces were designed to give each of the users plenty of opportunity for comments. The questionnaire was printed on coloured paper to give it an identifiable appearance. The questionnaire was sent out with a letter of transmittal (also given in Appendix A) which described the purposes of the questionnaire survey and introduced the representatives and agencies involved. A stamped return address envelope was also included in each of the packages sent to the users.

A French version of the questionnaire was also prepared once the design of the questionnaire was completed. The French version was available to anyone on request and was sent to one user who requested it.

Table 1. Question blocks of the Questionnaire Survey

Block	Description	Quest. Page
a)	**User Profile Information**	
1.	User Identification	1
2.	Type of Water Resources Activity	1
3.	Water Resources Projects/Studies	2
b)	**Data Uses, Types and Provision**	
4.	Types of Data Used	2
5.	Provision of Data to the Users	2
6.	General Data Needs	3
7.	Data Analyses by the Users	3
8.	Data Interpretation Suggestions	3
c)	**Network Requirements**	
9.	Data Requirements in the Existing Network	4
10.	Insufficient Data Areas of Ontario	4
11.	Comments/Suggestions/Requests	4
12.	Responses to Map of Ontario Watersheds	Map

ONTARIO REFERENCE MAP

DRAFT HYDROMETRIC DATA USER QUESTIONNAIRE

(Please mark on the map and/or check off the boxes below)

Map from: Atlas - Water Quantity Resources of Ontario, OMNR

201 Drainage Basins

Hudson	☐	Erie	☐
Nelson	☐	Ontario	☐
Superior	☐	Ottawa	☐
Huron	☐	Outside Ontario	☐

Indicate areas where hydrometric data required.

Figure 1. Map of Major Watersheds in Ontario.

3. DATA BASE OF HYDROMETRIC DATA USERS

3.1 Selection of the Mailing List of Data Users

A comprehensive list of users in Ontario hydrometric data was developed for this project. An effort was made to include all known users and potential users. The mailing list or distribution list for the questionnaire survey was prepared from the comprehensive list. The goal in the selection of users for the mailing list was to obtain a large representative group of users of Ontario hydrometric data.

The comprehensive list of data users and the mailing list for the questionnaire survey were developed on a micro-computer using data base management software (ie. Pro/Datatrieve software running on a PRO-380 micro-computer (Digital Equipment Corp.)). The mailing labels for the questionnaires were also prepared with this software. During the development of the list of users the computerized approach allowed summary lists of various types to be prepared easily for review. The computerized approach has improved the capability to manage information efficiently for example in organizing, sorting, updating and maintaining the information on Ontario hydrometric data users.

For the survey by questionnaire to be effective in canvassing the needs and views of hydrometric data users a good representation from the various user groups was necessary. At the time of selecting the mailing list the total number of users recorded in the computerized data base was approximately 460. A total of 367 users were selected for the questionnaire mailing list. Some of the companies included in the larger list had more than one user as an active requestor of hydrometric data/information and some had multiple office locations and/or departments. An effort was made to include all companies, agencies and individuals who had requested data within the past three years with at least one representative on the mailing list. Any ommissions from this list which may have occurred were not intentional.

The mailing list of hydrometric users was put together from several sources including: WRB - Headquarters mailing list for data publications, WRB-OR list

of active hydrometric data users, suggestions by NEPS representatives, and agencies thought to be potential users based on available information. Although the list of 367 users did not include every active and potential Ontario hydrometric data user the list was deemed to have a good representation of the majority of agencies and companies.

Figure 2 shows the distribution of the 367 users between the following four users groups: Federal, Provincial, Consultants and Others. Four groups were identified to keep the number of groups to a small number for analysis purposes and yet to sub-divide the total group into meaningful groups for a better understanding of the results. Appendix B gives the complete list of 367 users selected for mailing.

Table 2 shows the breakdown of 367 users according to category and agency. The Federal category includes 53 users with the predominant agency being Environment Canada with more than half of the total. The Provincial category shows a total of 94 data users with several users from each of the agencies represented in the Cost Sharing Agreement for Water Quantity Surveys as well as from other provincial agencies. Of the 94 data users 40 were from the various Conservation Authorities in Ontario. The "Consultants" category was somewhat loosely defined to include data users from companies or agencies who were engineering consultants or were thought to be involved in providing consulting services in the water resources and related fields. Some of the users in the "Consultants" and "Other" categories were located outside of Ontario.

The "Others" category included 106 data users. As shown from Table 2 this category covers a wide range of users with quite varied interests in Water Resources. A major component of this group is the Educational group with representation from the Universities and Colleges in Ontario. A few of the users in this group were representatives from agencies of the United States Government.

3.2 Data Users Responding to the Questionnaire

On October 3, 1986 367 questionnaires were sent out to users of hydrometric data. Each of the packages sent out included the questionnaire with user mailing label attached and with a stamped return envelope enclosed. An effort was made to encourage the candidates to respond by making the process a convenient one with a simple return mail procedure.

As of December 31, 1986 205 questionnaire responses were received. Of the questionnaires returned 19 were returned as a result of unknown new addresses. With 19 removed from the total number of questionnaires sent out the overall response rate was approximately 60 percent (ie. 205 of 348). Figure 3 shows graphically the distribution of the 205 users who responded according to the user groups described above. The results show a good response rate from each of the user groups with the overall result that a good representation of data users in Ontario was evident. The response rate from each of the user groups was approximately balanced at close to 60 percent.

Table 2. List of Companies/Agencies on User Mailing List.
Listed by User Group (Total number of users in brackets).

Companies/Agencies	No. of Users
Federal (53)	
Environment Canada	30
Agriculture Canada	6
Fisheries & Oceans	2
Energy, Mines & Resources Canada	3
Public Works Canada	2
Dept. of Indian and Northern Affairs	2
Canadian Hydrographic Service	2
Lake of the Woods Control Board	1
Ottawa River Regulation Board	1
International Joint Commission	2
Other	2
Provincial (94)	
Ontario Ministry of Natural Resources (includes: Conservation Authorities, 40)	55
Ontario Ministry of Environment	16
Ontario Ministry of Transportation	3
Ontario Ministry of Agriculture & Food	4
Ontario Ministry of Energy	1
Ontario Hydro	13
Other	1
Consultants (114)	
Representatives from 104 different companies.	
Other (106)	
14 Universities	34
6 Colleges and other schools	7
Local governments	3
Agencies of United States	6
Private Individuals	20
Other companies and agencies	36

Figure 2.

NUMBER OF QUESTIONNAIRES MAILED

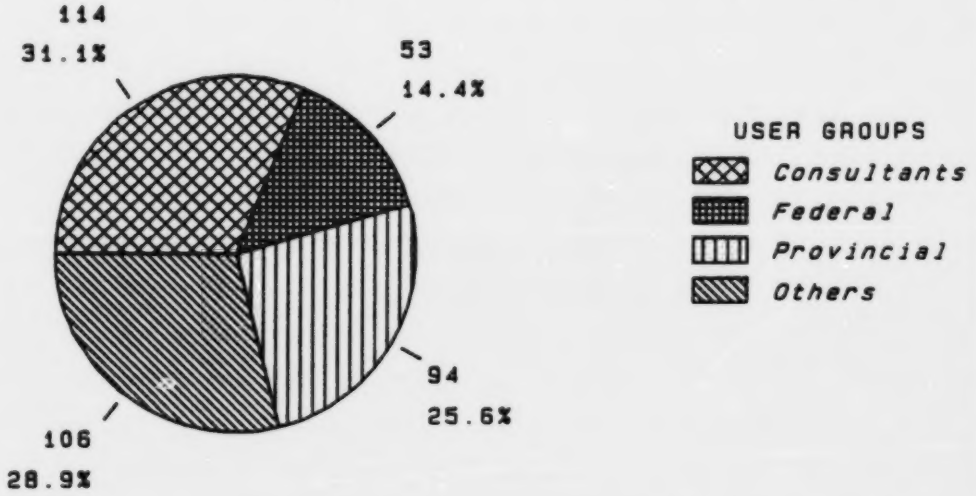
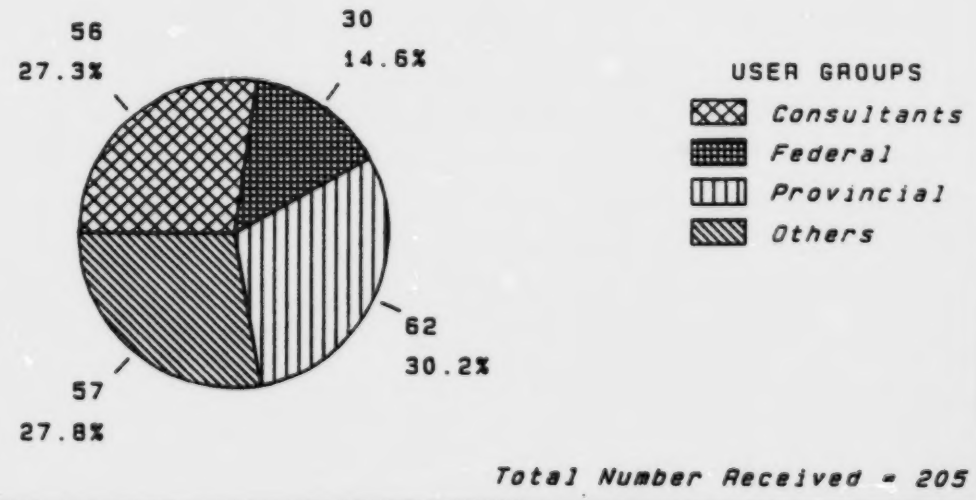


Figure 3.

NUMBER OF QUESTIONNAIRE RESPONSES



4. QUESTIONNAIRE RESPONSE INFORMATION

This chapter contains a description and interpretation of the Questionnaire response information. The response information for each of the 12 question blocks was analyzed as given in the following 12 sections.

The first three sections provide information related to the identification and profile of the data user. Some answers are provided to the following questions: Who is the user and What type of work does the user carry out? and What are the general applications which require hydrometric data?

The next five sections provided information on the specific data needs of the users. What data/information does the user require and how quickly are the data required? Is the process of providing data to the user adequate? The user was also asked to describe data analyses carried out and also what suggestions the user may have for data interpretation studies to be done by the data collection agencies.

In the final four sections the users were asked to comment on the adequacy of the hydrometric network in Ontario. The users were asked to consider the existing network and new developments to the network. A map of major watersheds in Ontario was provided and used to address the question of where the requirements for hydrometric data are located. The users were also given an opportunity to make any other general comments or suggestions or requests.

The response information was managed and analyzed using Datatrieve, data base management software. The information was entered in fields according to the question structure and printouts of responses according to user groups were reviewed. This proved to be an effective wasy of reviewing the large number of responses. Both narrative and check-off type responses were analyzed in this manner.

4.1 User Identification

The names and addresses of the users were catalogued and grouped using the data base management approach as presented in Chapter 3. This provided a flexible approach to manage the information and also provided a quick way to produce mailing labels for the questionnaire packages. Summary lists of basic user information were reviewed throughout the project. For example the summaries of basic information yielded the necessary information for mailing list selection and for monitoring of responses as received.

As each questionnaire response was received the information provided by the user in the user identification portion of the questionnaire was compared to the mailing list and updates to the data base were made as necessary. Update information was provided from all returned questionnaires.

4.2 Type of Water Resources Activity

In this block of questions users were asked to "Please indicate the type(s) of water resources activity your agency is involved in". Six different types of activities were provided as possible responses:

1. Design of Water Resource Structures/Equipment
2. Water Resources Regulation/Operation
3. Water Quality Investigations/Monitoring
4. Flow Forecasting & Flood Warning
5. Water Related Studies/Research
6. Other (Please specify)

This information provided further description for user profile information. It characterized the responding users according to water related function rather than governmental or other organizational types. 195 users responded to the question.

From the response information displayed in Figure 4 a general picutre of the water related activities of the user community in Ontario emerged. It can be seen that in the area of design of water resource structures and equipment the Provincial and Consultant agencies are greatly involved and by strong contrast the Federal and Others categories show far less involvement. In the area of regulation/operation of structures the Consultant group show less involvement but in this case the Provincial group show considerable involvement.

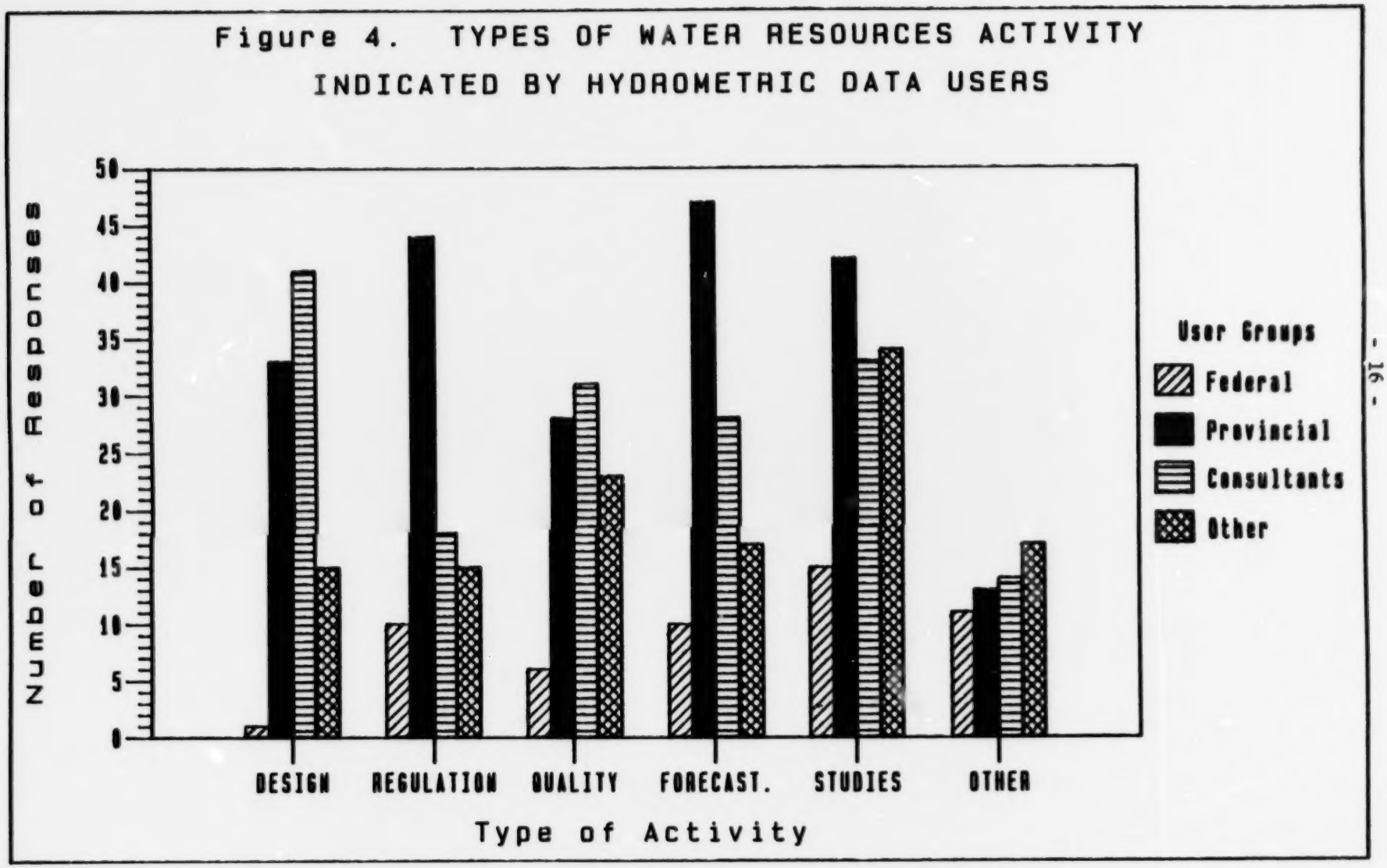
The Consultant group shows strong involvement in each of the types of activities. This seemsn to demonstrate the integral involvement of the Consultant community in water resources activities in Ontario.

Each of the groups showed activity in the area of water quality investigations/monitoring (ie. approximately one-half of the responses). Each of the four categories of users, Federal, Provincial, Consultants and Others were well represented in the area described as water related studies/research. This seems to indicate that much study or research

activities occur alongside of operational programs. It was observed that for all six activity types of user groups indicated at least some involvement.

From 195 users who responded to this question 522 individual responses were indicated. This yielded a ratio of approximately two and one-half responses for every user which was a definite indication of the multiple interests/roles of many of the users. Fourteen Conservation Authorities indicated involvement in all of the five types of activities indicated.

Figure 4. TYPES OF WATER RESOURCES ACTIVITY INDICATED BY HYDROMETRIC DATA USERS



4.3 Water Resources Projects/Studies

In this block the users were asked to "Please list the water resource projects/studies which your agency has carried out or has planned which require hydrometric data. If possible, identify any reports which have been prepared on these activities." Although the question required a narrative response which requires more time to complete than a check-off type of response the majority of the users responded (ie. 149 of 205). Some of the users replied at length on separate pages.

The responses provided an extensive list of water resources related studies/projects of a recent nature. Table 3 shows a list of topics which were evident from the many responses. Although the list of projects as given by the responding users is not a complete inventory of water related projects in Ontario, a strong confirmation was given of the vast extent of projects being persued and which require hydrometric data. Many watersheds were specifically mentioned in the responses but are not listed in this report since this would be too lengthy and would still only indicate a partial list of the watersheds of concern to the users and may thereby be somewhat misleading if presented.

Table 3. List of Topics Included in Responses to:
WATER RESOURCES PROJECTS/STUDIES

Great Lakes Related Studies
International Concerns/Studies
Northern Ontario Issues
Water Regulation/Operation
Water Supply
Flood Forecasting
Floodplain Mapping
Flood Management Studies
Flood Frequency Analysis
Low Flow Analysis
Water Quality Studies
Sewage Plant Effluent Monitoring
Environmental Assessment
Fisheries Concerns
Emergency Response Studies
Sediment Transport
Dredging
Water Structures Design/Evaluation
Small Hydro Assessment/Design
Urban Hydrology/Subdivision Developments
Channel Modifications
Erosion Control
Feasibility Studies
River Ice Investigations
Impacts of Tile Drainage/Land-Use Changes
Rainfall Runoff Modelling
Hydraulic Studies
Hydrology of Basins
Marshland Studies
Groundwater Investigations
Snowmelt Analyses
Climate Change Impacts Assessment
Water Budget Studies

4.4 Types of Data Used

The data users were asked to check off which of 16 types of data were used or required by them. Figure 5 shows the response rate for each of the 16 types of data. About 94 percent (ie. 193 of 205) of the users who responded to the questionnaire completed this question. Although the types of data as defined in this question are not independent of each other the types indicate various predominant features of interest.

At least half of the users who responded indicated a requirement for or use of the following types of data: hourly, monthly, annual, mean, maximum, minimum, instantaneous, discharge, water level, rating curves. Approximately one third of the users who responded indicated use of sediment data, ice thickness, cross-section, and water temperature data. The strongest response was shown for daily discharge and water level data which is the major focus for the hydrometric data collection agencies. It was observed that not all data users use all types of data but that many of the users utilize several types of data.

From the comments portion of the question other types of data/features were identified as being used or required. These included drainage area, lake levels, location information, continuous data, and short time interval data (eg. hours or minutes). Most of the "other" data identified is available from the data collection agencies and can be obtained on request.

Approximately two-thirds of the respondents to this question indicated "yes" to the question "is the type of data being collected suitable for your purposes? Comment?". Of those respondents 29 made additional comments concerning data types. These comments included such evaluations as: data suitable but not always available at desired locations, data requirements depend on projects, would like to see data on watercourses where future developments are planned, data suitable but require some specialized products (eg. snow depth and melt information, more data for small watersheds) and have had good co-operation from data collection agencies.

Approximately 15 percent of the users (ie. 28 of 193) provided comments

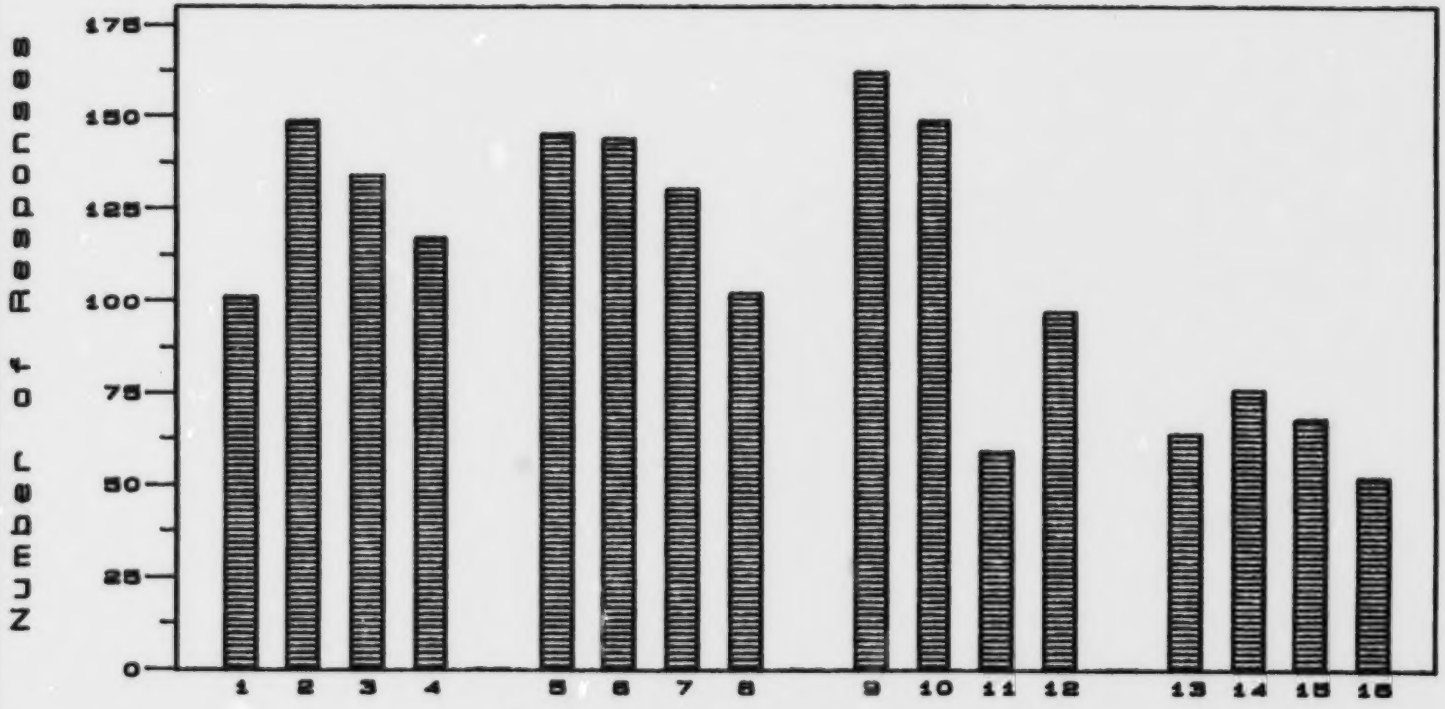
concerning shortcomings and the remaining 15 percent left the data suitability question blank. The comments included concerns such as: effects of regulation not adequately documented, better access to rating curves/data required on occasion, usually time steps are too coarse for detailed modeling, sparseness of the network makes hydrologic estimating difficult in many districts, could have used published monthly extreme values, insufficient coverage of lake watershed values, discharge ratings at regulated sites require verification/correction, lack of sediment data in area of interest, type of data depends on project especially with respect to time resolution, need a more detailed sampling program, require published hourly data for project work, data required collected by other agencies.

In some cases the question was misinterpreted and information was provided which pertained more to questions posed later in the questionnaire. This made the interpretation of results more difficult but also provided some useful information on the concerns of some of the users.

Figure 5.

Hydrometric Data User Questionnaire

Types of Data Used



193 Users responded to this question.

TYPES OF DATA USED

1 - Hourly	5 - Mean	9 - Discharge	13 - Ice Thickness
2 - Daily	6 - Maximum	10 - Water Level	14 - Velocity
3 - Monthly	7 - Minimum	11 - Sediment	15 - Cross-section
4 - Annual	8 - Instantaneous	12 - Rating Curves	16 - Water Temperature

4.5 Provision of Data to the Users

This block of questions pertained to the mode and time factor for provision of data to the users. The question topics included: the "turn around" time for provision of data, the need for "near-real-time" data, the form of data transfer (eg. publication, computer tape, telephone requests, and microfiche), and interest in interactive computer communications for transfer of data. Of the 205 users who responded to the questionnaire 191 (ie. 93 percent) users provided a response to this block of questions.

The users responded as shown in Table 4 to the question "Within what time frame(s) after occurence do you require data?...within hours, one day, one week, one month, longer". It should be noted that there were 275 responses indicated in this portion of the question block which indicates the multiple response by some users. Several of the users require data within several different time frames for different projects. A significant number of users accounting for approximately one-quarter of the responding users indicated a very urgent need for data within hours of occurrence (ie. real-time). Approximately 42 percent of the users indicated the need for data within one day (ie. near real-time). Approximately 47 percent of the users indicated within one week or one month time frame. Approximately one-half of the responding users indicated the need for data was not urgent and could be supplied within a time period longer than one month.

Table 4. Responses to Provision of Data Within Certain Time Frames

	Time frame	No. of Users	Percent of 191
Within:	Hours	48	25
	One Day	33	17
	One Week	35	18
	One Month	56	29
	Longer	103	54

The users were asked to indicate "what form of obtaining hydrometric data do you use". Out of the 191 responses from the users for this question block 81 percent of the responses indicated use of publications, 32 percent of the responses indicated use of computer tape, 54 percent indicated use of phone requests and 9 percent indicated use of microfiche.

The users were also asked to indicate if they were experiencing "an increasing need for 'near-real-time data' acquisition". Of the 157 users who responded 81 indicated "yes" and 76 indicated "no". This indicates that at least one-half of the responding users perceived an increasing need for this type of data. This fact was reinforced by several of the responses to one of the following questions on the use of interactive computer communications to obtain data. It seems that the need for real-time data and interest in interactive computer communications are strongly linked in many cases.

On the question "Are you using or interested in using interactive computer communications for the transfer of data?" about two-thirds of the responses (ie. 117 fo 170) indicated "yes". Many of this group of users indicated the need for real-time data and/or the increase in efficiency expected with this approach. Several users indicated that they are not presently using this approach but have a strong interest for use in the near future. Some of the users indicated that they are already involved in the application of this approach through the use of modem calls to data logging equipment, and the use of Interactive Procedure for Automated Retrievals (IPAR) which is available from Environment Canada. Some users indicated the operation of their own data banks. A few users indicated difficulties in using the computer communications approach including difficulties due to diversity of data formats between data loggers and various computer procedures.

Approximately one-third of the users responded to the question "Do you have any comments or suggestions for enhancement to the present system of supplying data to users". A summary of these comments and suggestions is presented in Table 5.

Table 5. Comments provided on suggestions for improving service of provision of data to users.

- provide data through computer communications
- computer access through networks (eg. ENVOY-100, NETNORTH)
- provide data on computer diskette (many preferred IBM, MS-DOS format)
- listing of data types available
- review of data formats/publications perhaps can have a better design
- system to automatically forward new data as becomes available
- request for more "phone-in", data logger stations
- present system of data provision is adequate
- easier access to hourly data of interest
- shorten "turn-around" time for data provision especially urgent requests
- increased access/provision of "real-time" data
- need for additional information (eg. definite statements regarding accuracy/errors/levels of relaiability, station history, history of flooding or droughts, basin/watershed information, documentation of effects of regulation)
- basic interpretive reports for example on floods, droughts, water balances would assist many users
- holding a Data User Workshop
- need for other types of hydrologic data as well (eg. climatologic)

4.6 Changing Data Needs

This block of question concerns some general aspects of the hydrometric data collection program. The following questions were asked "Does your organization carry out streamflow, water level, or other water measurements? Are your requirements for hydrometric data increasing? Decreasing? Comments? If possible please comment on your data needs regarding accuracy, length of record, continuity of data."

Approximately two-thirds of the users who responded (ie. 128 of 188) to this question indicated that they carry out water measurements for example streamflow, water level or other type(s). Most users indicated that the measurements were carried out occasionally and/or on an as required basis. The Provincial group of users indicated the highest ratio of users involved in data collection. That is 54 of 61 users in the Provincial user group indicated "yes". In general it is apparent that a large number of agencies are carrying out various data collection efforts in the water resources field in Ontario. Several of these agencies supply data to the Water Resources Branch of Environment Canada for inclusion in the data publications as contributed data.

When asked "Are your requirements for hydrometric data increasing? or decreasing? or comments?" approximately two-thirds of the responses (ie. 124 of 196) indicated increasing requirements. Figure 6 shows the response statistics for this question. Only 6 users of the 196 who responded to this part of the questionnaire indicated a decreasing requirement. That translates to about 3 percent. About one third of the users (ie. 66 of 196) either left this particular item blank or indicated no change in data requirements. This response information is a strong signal for the direction of change to be expected in requirements for data in the future.

About one-third of the users provided additional comments to the question of increasing or decreasing need for data. Since most users had previously indicated that they were experiencing an increasing need most of the comments provided explanations for this increase in data requirements. About a dozen users indicated that needs were increasing due to development or further

development of flood warning and/or forecasting systems. Several users indicated the need for data in calibration and verification of hydrologic or hydraulic models (which may also be part of a flood forecasting system). Several users indicated an incresing need for "near-real-time" data. Some users indicated that more structures or development projects were being considered. A few users mentioned the application of flood frequency analyses in this question of increasing data requirements. Water quality assessment needs were also indicated.

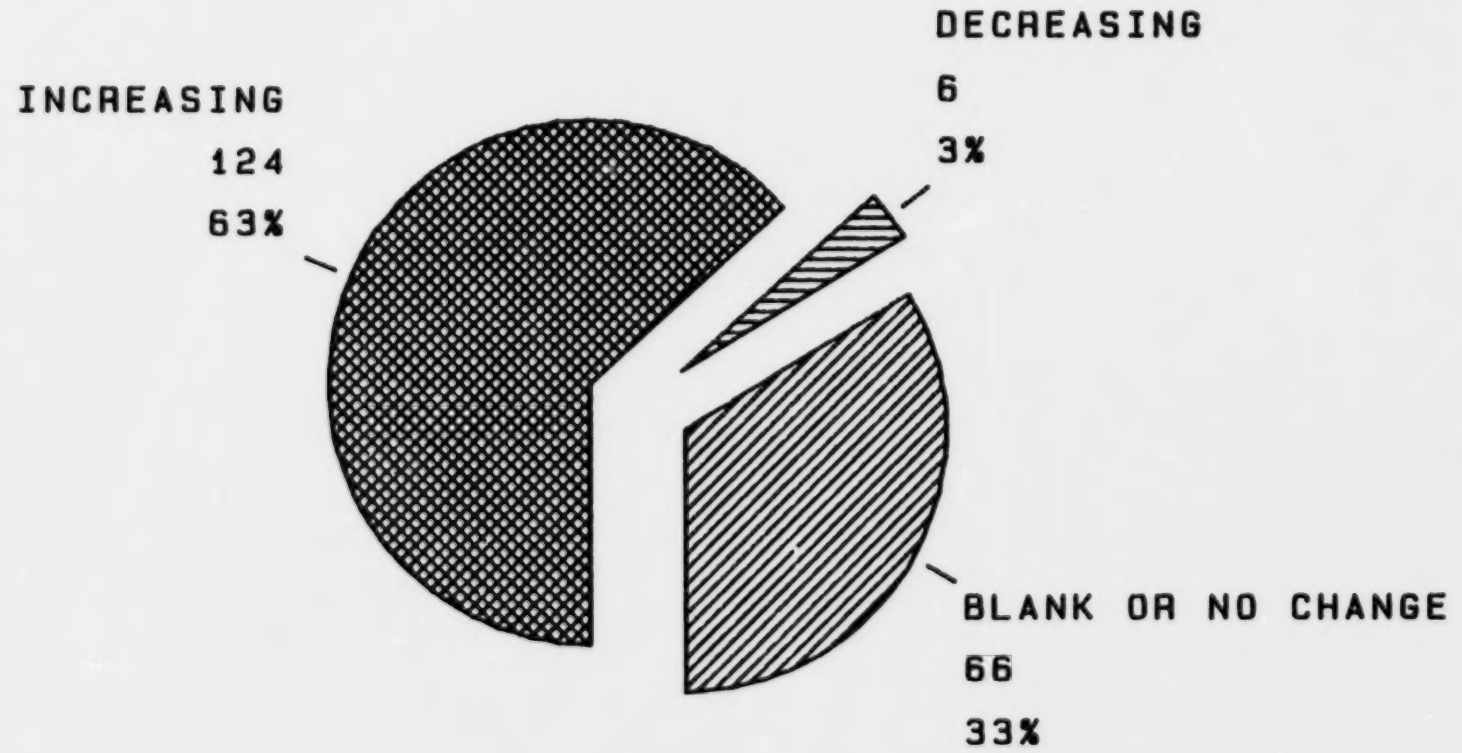
Several users provided general comments concerning changes in data needs. Some indicated that the number of monitoring sites available is not sufficient. Northern Ontario was particularly mentioned as having the problem of insufficient data. Some users on the other hand indicated a relatively stable requirement for data and that the existing network was adequate. Some users from educational institutions indicated that they use whatever is available. Several users indicated that often more data was required in their particular area or watershed of study. The concept that data needs depend on the type of project(s) was mentioned in many responses. The general concept that more is better also came through in many responses. Some users indicated a need for more gauging of small to medium sized watersheds. The need for more gauging of urban catchments was mentioned. Some users indicated specific areas of the Province where increased data is needed. Experimental watersheds where intensive gauging programs would be carried out for a time were suggested. The need for more high flow data was also suggested.

Some of the respondents provided some reasoning to explain the increasing data requirements. One user commented that water management programs rely heavily on hydrologic data and another user commented that engineering studies are becoming more data intensive. Comments were given that indicated that larger scale, integrated studies lead to increasing data needs. For example global monitoring programs were identified. Other users identified what they felt are influencing factors in the need for hydrometric data. For example one user identified "favourable economics" as an influencing factor. This seemed to suggest that under this type of general economic conditions needs for data would increase. Others identified "public accountability" and "public pressure" and "research funding" as influencing factors in the changing needs

for data. These comments seemed to suggest that public involvement and government action affect data requirements due to various projects undertaken or not undertaken and also affect the data collection program ability to respond to the data reqirements.

When asked to comment concerning accuracy, length of record and continuity requirements a wide range of responses were given. About one-half of the respondents provided comments. Many users indicated that all of the above aspects were important. Many of the users mentioned at least one of the factors as being important. Very few responses provided a quantitative indication of what accuracy is required (eg. maximum acceptable percentage error) or what length of record is required (eg. number of years).

FIGURE 6. CHANGING DATA REQUIREMENTS?



4.7 Data Analyses By the Users

The users were asked to indicated "what kind of data analysis do you carry out?" Several options were provided as shown in Table 6. 185 Users responded to this question which yielded a response rate of 90 percent. In total the number of options indicated was 907. This translates to an average of 4.9 analysis types per responder. This points to the varied and extensive water resources applications which require hydrometric data in Ontario.

Table 6. Types of Data Analysis Carried Out by the Users

	Types of Data Analysis	No. Responses
1.	Basic statistics (mean, variation, ...)	130
2.	Flow Duration Analysis	80
3.	Flow frequency analyses	112
4.	Correlation of stations	79
5.	Rainfall-Runoff modelling	115
6.	Determine Dependable Flows	68
7.	Hydraulic analyses	101
8.	Determine Unit Hydrographs	88
9.	Estimation of record at ungauged sites	94
10.	Other	40
	Total	907

The 21 Federal responses indicated the strongest need for "Basic statistics" kinds of analyses. The "Estimation of record at ungauged sites" and "Rainfall-Runoff modelling" options were also indicated in more than half of the Federal responses. On average 4.1 analysis types per Federal user were indicated.

More than half of the Provincial responses indicated the application of each of the analysis types except for the "Determine Dependable Flows" and "Other" options. The responses indicated clearly the wide scope and the extensive amount of analysis by the Provincial group. The responses indicated an average of 5.1 analysis types per user.

The consultant group had 54 responses with more than 75 percent of this group indicating the following analysis types: "Basic statistics", "Flow frequency analyses", "Rainfall-Runoff Modelling" and "Hydraulic analyses". This group showed at least half of the respondents carrying out each of the analysis kinds. The group showed the highest average analysis types per user at 5.6.

The remaining group of users showed that at least one third of the responders were carrying out each of the analysis kinds. The strongest application was the "Basic statistics" option with 75 percent of the responders. For the 48 users in this group which includes the educational users, private companies and individuals and other agencies (eg. Municipal, U.S. Government) 202 total analysis types were indicated which yielded an average of 4.2 types per user.

In the category of "Other" analysis types several comments were provided by the users which expanded the list of types of analyses as shown in table 7. Several responses from Conservation Authorities indicated that Consultants had been contracted to carry out some analyses for their purposes. A few agencies indicated that the stream gauging program was a relatively new concern for them and that analyses had not yet been carried out.

The users were also asked to indicate "What other types of data do you use in projects involving streamflow data?" The options given were: precipitation, groundwater, snow, soil moisture, water quality parameters, and other. A very strong response was shown for the use of precipitation data with 153 of the 185 respondes. The responses also showed a considerable use of: snow data, water quality parameters, groundwater and soil moisture data. Table 8 below shows the number of responses obtained for the above types of data. Several other types of data were indicated in the 27 responses as shown in tables 8 and 9.

Table 7. Additional Types of Analyses Carried Out by the Users

Base Flow Calculations
Flow Forecasting/Prediction
Real Time, Near Real Time Analyses
Mass Curve, Double Mass Curve Analyses
Flow Routing
Hydraulics (eg. including Ice conditions)
Flow Regulation (eg. Optiminzation Modelling)
Interrelationship investigation with other parameters
Snowmelt Modelling (eg. with Rainfall-Runoff Modelling)
Statistical Analyses
Nonparametric Methods
Regional Analysis
Time Series Analysis
Risk Analysis
Sensitivity Analysis
Design Projects
Water Quality Analyses
Cartography
Use of Remotely Sensed Data
Educational Applications

Table 8. Number of responses for 'Other' types of data

Data Type	No. responses
Precipitation	153
Groundwater	63
Snow data	117
Soil moisture	56
Water quality parameters	83
Other	27

Table 9. Other types of data used in projects involving streamflow data (Comments provided by Users)

-Climatic/Meteorological Data	-Biological Data
-Air Temperature	-Physiographic Data
-Evapotranspiration	-Land Uses
-Dew Point Temperature	-Remotely Sensed Data
-Wind Speed, Direction	-Geodetic Controls
-Humidity	-Historical-Verbal Records
-Radiation	-Lake Levels
-Sunshine Hours	-Sewage, Drainage Works
-Precipitation Chemistry	
	-Water Quality
-Temperature (Water, Soil)	-Suspended Solids
-Ice Data (eg. thickness, quality, jams)	-BOD
-Flow Timing	-Trace elements (Mass flow)
-Cross-sections	-Pesticide Residues
-Water surface slopes, Gradients	
-Volume of flow	
-Flood frequency information	

4.8 Data Interpretation Suggestions

An opportunity was provided in this question for the User to comment on "What type(s) of data interpretation or analyses would you like to see being done by the agencies collecting and disseminating the data?". Example types of analysis were used from the previous question block. The number of responses was 91 with approximately 170 suggestions indicated. Table 10 provides a breakdown of the suggestions.

Table 10. Suggestions for Data Analyses by Data Agencies.

Analysis type	No. responses
Basic statistics (mean, variation, ...)	10
Flow Duration Analysis	13
Flow frequency analysis	28
Correlation of stations	14
Rainfall-Runoff modelling	16
Determine Dependable Flows	5
Hydraulic analyses	2
Determine Unit Hydrographs	9
Estimation of record at ungauged sites	9
Other	61
Total	170

The "Other" category shows the largest response with a wide variety of suggestions offered. Table 11 lists the suggestions given in point form.

Table 11. "Other" suggestions for Data Analyses by the Data Agencies.

-Estimation of missing data	-Streamflow Hydrographs
-Quality control of data	-Annual patterns
-Trend analysis	-Long term flow curve
-Accuracy/Error analysis	-Elevation duration analysis
-Description of accuracy	-Base flow analysis
-Status of hydrometric records	-Correction of past records
-Description of factors affecting data	-Level fluctuations
-Simplified surface water overviews	-Climate-streamflow comparisons
-Volume statistics (eg. annual peak vol.)	-Ice jams/effects documentation
-Statistical analyses	-River ice forecasting
-De-regulation of flows	-Snow Surveys
-Water surface profiles	-Evapotranspiration calculations
-Low flow analyses (software also)	-Infiltration rates
-Drought flows analysis	-Differences of seasonal flows

Additional suggestions were made including: wave frequency analysis, lake surge calculations, long range precipitation forecasts, water quality assessment, extrapolation of flows for next year, determination of 1:10,000 year flows, economic analysis related to risk analysis, and regional storm analysis.

Approximately five of the "Other" suggestions indicated that the data collection agencies should focus on the primary requirement for basic data and to leave analysis to other groups (eg. the private sector).

Some general comments were also given by various users as follows. Standard procedures should be applied and documented for analyses. For example standardized flow frequency analyses would be useful including software availability. Also more detailed description of factors affecting streamflows at the sties should be provided. For example hydrologic changes in the watersheds should be investigated and documented. It was also suggested that a

more consistent approach to data estimation could be provided by the data collection agencies. For example the goal could be to provide data and methodologies for estimation of flows at all ungauged sites. Various data analyses and provision could be done in conjunction with climate data/information. For example data products corresponding with climate summaries could be provided. Accuracy investigations/assessments were also of interest to several users. Also the emphasis on regional investigations by the data collection agencies was also suggested.

A large majority of users are in favour of the data collection agencies providing data interpretation and analyses however a few users indicated opposition to analyses being done by the data collection agencies. With the wide variety of suggestions provided by the users it seems clear that careful planning should accompany any change in analysis and interpretation work by the collection agencies.

4.9 Data Requirements in the Existing Network

The ninth question block requested information on the "critical need for hydrometric data of specific stations in the existing network". This section describes the comments provided by 64 users which represents a response rate of approximately one-third of the users. The term "critical" was used to emphasize a strong definite need for data. For some users it was difficult to identify "specific stations in the existing network". The breakdown by user group for the 64 responders was as shown in the Table 12.

Table 12. Users responding to question regarding critical needs for data.

User Group	Quest. 9	Total Response	Percent
Federal	9	30	30%
Provincial	31	62	50%
Consultants	7	56	13%
Other	17	57	30%
Total	64	205	31%

For the Provincial group 50 percent of the group gave comments defining the critical data needs. Of the 31 Provincial Users who responded 20 belonged to the group of Conservation Authorities. Some users clearly defined the stations where data is required. For example the stations within certain watersheds. Other users provided general types of definition to their critical needs. For example where Provincial highways cross watercourses (which defines a multitude of points throughout the Province). Other example comments included: Lake Huron watershed, Ottawa River watershed and most of Eastern Ontario, Northern Ontario draining to Hudsons Bay.

The Federal users indicated some general areas of critical need including: Rideau River area required by Parks Canada, all lake levels required by the Canadian Hydrographic Service, Lake of the Woods area by the Lake of the Woods Control Board and Secretariat. Other areas mentioned were the International waterways, Northern rivers draining to James Bay, and areas defined by project type. It seemed that only a few examples of critical need were provided by the nine Federal Users who responded to this question leaving many areas of critical or important data needs not mentioned by other Federal Users.

Responses from the Consultant group usually indicated that data needs were defined by project rather than by geographical or watershed areas. It seems likely that this is a representative type of response for the majority of the Consultant group since work areas and hence data needs are largely driven by project assignments. Some general comments indicated that most future data requirements were unknown and difficult to predict. Nevertheless several of the Users indicated the general critical need for hydrometric data for small drainage areas, and for urban areas.

The Other category included several responses of Users from Universities. Several general watershed areas were mentioned as critically needed for example: Lake Ontario watershed, Lake Huron, Lake Erie, Toronto area, Grand River, James Bay, Niagara River and St. Lawrence River.

It seems that relatively few Users of hydrometric data can determine the exact location of critical needs. This is the case for present critical needs and is certainly more so for future needs. From the responses received it is quite clear that virtually all areas of the Province were identified in some form as areas of critical data needs. It should also be noted the responses represent only partially the total critical needs for hydrometric data in Ontario.

4.10 Areas of Ontario With Insufficient Data

The Users were asked to "please identify any areas of Ontario which have insufficient hydrometric data for your purposes. If possible, also indicate the amount and type(s) of data required". One-third of the Users (ie. 67 of 205) provided response information to this question. Most of the responses came from the Provincial and Consultant groups (ie. 51 of 67).

The eight responses received from Federal Users emphasized the need for data in Northern Ontario and in particular the Hudson-James Bay drainage area. Other areas mentioned included the Niagara Penninsula, Essex County, Haliburton area, and in general natural and small streams. The eight users indicated a large portion of Ontario as having insufficient data for their purposes. These Users represented a response rate of 27 percent for the Federal group.

The category of Users described as "Other" provided eight responses to this question which represented a response rate of 14 percent. Six of these Users were from Universities and the remaining two from private companies. the responses were quite varied including: Northern Ontario, Niagara Penninsula, Eastern Ontario, and generally small watersheds, urban watersheds, storm sewer outflows. Again very few Users identified specific sites or watersheds for new hydrometric data collection.

The Provincial responding Users totalled 26 of which 13 were from Conservation Authorities. The 26 Users represented a response rate of approximately 42 percent (ie. 26 of 62). The responses indicated specific watersheds and general descriptions including: small watersheds, long term stations required, urban watersheds, and tile drained areas (including before and after installation monitoring).

The 25 Users responding from the Consultant group gave a vast areas of the Province where data is deemed insufficient. Areas of the Province identified were: Northern Ontario, Spanish River watershed, Lake Huron Watershed, Southern Ontario long-term small watersheds including urban areas, Lake Erie watershed, Lake Ontario watershed, Ottawa River basin, Lake Superior watershed,

Toronto area, Hamilton area, North-Western Ontario, North-Eastern Ontario. The general data needs included: small watersheds, urban watersheds, representative watersheds. Examples of the description of "small" watersheds were: less than 25 square kilometres, less than 20 square kilometres and for Northern Ontario an example was 100 to 500 square kilometres. Other comments included the need for small watersheds in order to estimate flows at ungauged sites, and the need for a speed up in the flow determination process.

In summary the comments concerning areas of insufficient hydrometric data in Ontario were general and covered virtually all of Ontario which was particularly noticeable in the responses of the Consultant group. A recurring set of themes were evident from the review of all responses. These themes related to the need for data in Northern Ontario (particulary the Hudson-James Bay drainage area), for data in the Niagara Penninsula area, for data of small watersheds, and for watersheds in urban areas. These many varied needs will need to be addressed in future network planning efforts.

4.11 User Comments/Suggestions

In this section the Users were asked to "Please indicate further information, references or suggestions which would assist in the evaluation and planning of the network." 31 users responded providing a wide variety of comments and suggestions. A few references were cited regarding network evaluation and planning and regarding the accuracy of hydrometric data. Several of the comments re-emphasized selected items given in earlier sections.

The four Federal responses provided the suggestions to carry out flood frequency analyses for all stations, to provide information on major water uses in the watersheds, to collect and provide river ice data/information and to make use of network evaluation and planning information carried out by other groups.

Of the 14 Provincial Users who responded 7 were from Conservation Authorities. The Users from the Conservation Authorities suggested: data collection for urban areas, installation of more new stations, reporting on water quality parameters, extensive co-ordination of the data collection program, collection of precipitation data at streamflow data stations, expansion of the real time data service, and providing easier access to collected data. The other Users in the Provincial group suggested: identifying stations with flooding problems, providing an information flyer on the means to obtain hydrometric and climatological data/information. Additional suggestions included: reporting on water chemistry, increasing the real time service, providing data on computer diskettes, and gauging at more supplementary gauges such as crest-stage gauges.

The Consultant category showed 9 responses. Several concerns/suggestions were described as summarized below: checking data for dams and power plants, providing data for small watersheds and urban watersheds, extending the automated data collection approach, emphasis on the continuity of data collection at the sites, obtaining input from the Users in the network evaluation and planning process, developing a more extensive network of basic data, increase in data/information for sediment, basin characteristics and river morphology.

The Other category had four responses three of which were from Universities. The main comments provided were regarding: accuracy and continuity of data, provision of snow data, the suggestion to review and assess the need for new types of data (eg. satellite data). Other comments were: to increase the network in Eastern Ontario, and the provision of two references concerning the accuracy of discharge determination.

4.12 Responses to Map of Ontario Watersheds

A one page map with the seven major watersheds in Ontario was provided with each questionnaire. The Users were asked to "Indicate areas where hydrometric data required" by checking off the boxes or by marking on the map. 171 Users responded to the question (ie. 83 percent response rate). Figure 7 shows the responses by watershed and by User group. More than one-half of the Users who responded indicated data requirements in the Lakes Huron and Ontario watersheds. Nearly one-half of the Users also indicated data requirements in the Lake Erie watershed. The remaining watersheds in Ontario showed a response rate of between 24 and 40 percent as shown below in table 13.

Table 13. Indicated Data Needs by Watershed

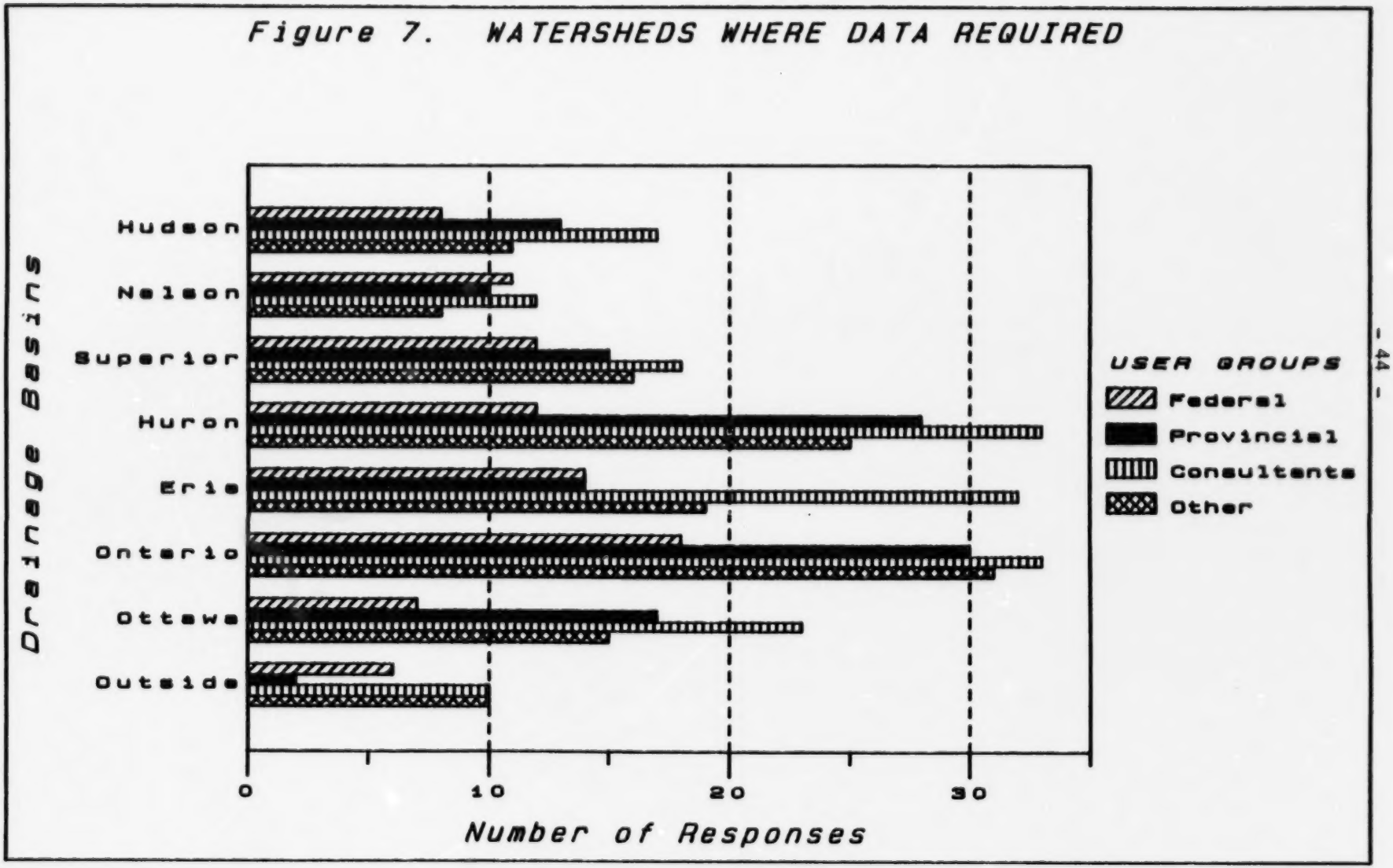
Watershed	Number of Responses	Percent of 171 Users
Hudson	49	29
Nelson	41	24
Superior	61	36
Huron	98	57
Ontario	112	65
Ottawa	68	40
Outside Ontario	28	26
Total	536	

The total number of watersheds indicated as areas of data requirement was 536 which yields an average of 3.1 watersheds indicated for each User responding. In general the requirements for data area more dominant for Southern Ontario than for Northern or Eastern Ontario. Nevertheless each of the watersheds

shows a significant demand for data. This pattern reflects the spatial density distribution of the hydrometric network which has developed over the years in Ontario. A considerably denser network of stations exists in Southern Ontario than other areas of the province.

The interpretation put on this question by the Users may be somewhat varied. From the responses it seems that many Users interpreted the question as watersheds where data will be required in the future. Some Users seemed to interpret the question as watersheds where data presently used and is required. Both interpretations indicate the data needs of the users.

Figure 7. WATERSHEDS WHERE DATA REQUIRED



5. GENERAL OBSERVATIONS

The responses by data users were in general very positive and extensive information was obtained via the questionnaire survey. Figure 8 shows the number of responses for each of the twelve question blocks of the questionnaire. A quite high response rate is shown for most question blocks. A lower response rate was obtained for the question blocks 8 through 11 which were questions regarding: data interpretation suggestions, data requirements in the existing network, insufficient data areas in Ontario, and user comments/suggestions. The questions with a lower response rate generally required a more lengthy narrative type response.

Approximately 60 percent of the users who were sent a questionnaire responded. The responses provided sufficient material to carry out analysis of results. A reasonably clear impression concerning the views of the user community emerged for each of the question blocks. Most of the response information provided direct answers to the questions. Some of the responses to particular questions being somewhat off-topic (due to what seemed to be different interpretations of the questions). Some of the responses to particular questions seemed to apply more to other question blocks.

The concern for more hydrometric data for small watersheds, and urban watersheds was expressed by many users. These data requirements were mentioned in response to several question blocks.

The data analysis types listed in Section 4.7 "Data Analysis by the Users", provided a useful breakdown of the extensive analyses going on in the user community. In Section 4.8 the above mentioned list was considerably expanded by suggestions from the users. The extent of applications and requirements for hydrometric data is wide ranging. The incorporation of other hydrological and related data in the applications by the users was also evident in the responses. The suggestions for analyses to be carried out by the data collection agencies were many and varied.

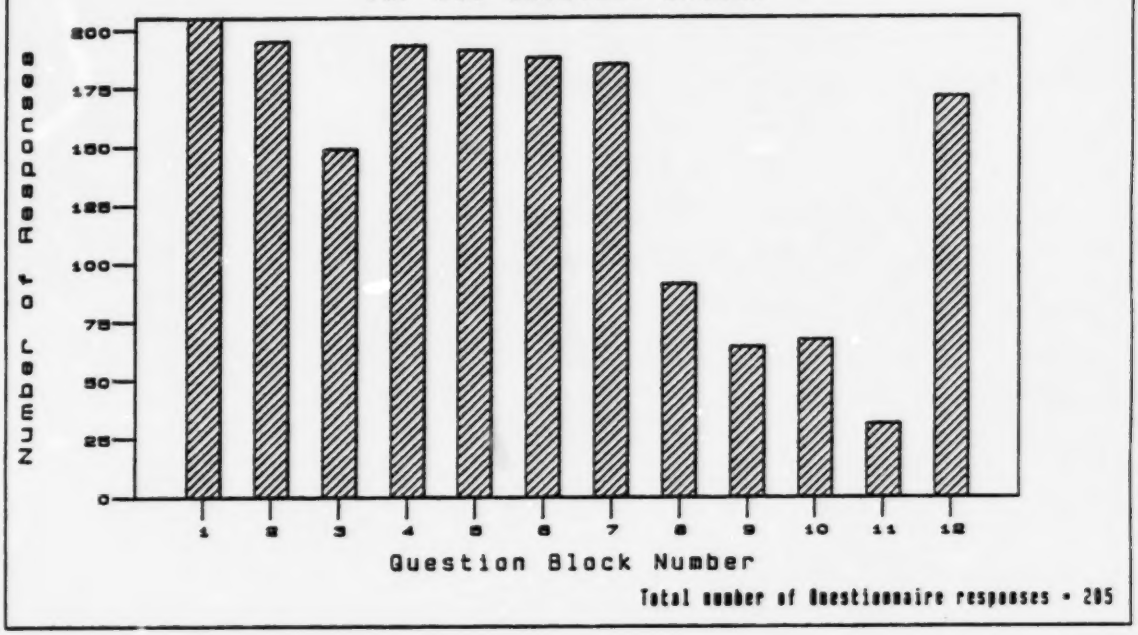
Some users provided general comments in the final section of the questionnaire

most of which re-emphasized concerns raised in earlier question blocks. For example comments suggested improvements in the data collection program in the following areas: additional information on hydrometric stations/basins, emphasis on the requirement for continuity in data collection at the sites, and increase in the network in data sparse areas such as Northern Ontario watersheds, small watersheds and urban watersheds.

The Province of Ontario was subdivided into 7 major watersheds on the map attachment of the questionnaire and users were asked to comment on areas where hydrometric data required. In order of most responses the basins were: Ontario, Huron, Erie, Ottawa, Superior, Hudson, Nelson. The largest requirement was shown for areas in Southern Ontario but a strong requirement was indicated throughout the province.

A clear indication of the users views was provided to virtually all question blocks. In many cases the responses were so varied that this aspect of variation in the responses is an important result to be noted.

Figure 8. Number of Responses for all Question Blocks



DESCRIPTION OF QUESTION BLOCK

1. User Identification
2. Type of Water Resources Activity
3. Water Resources Projects/Studies
4. Types of Data Used
5. Provision of Data to the Users
6. Changing Data Needs?
7. Data Analyses by the Users
8. Data Interpretation Suggestions
9. Data Requirements in the Existing Network
10. Insufficient Data Areas of Ontario
11. Comments/Suggestions/Requests
12. Responses to Map of Ontario Watersheds

6. CONCLUSION

The questionnaire survey responses provided an extensive amount of feedback information from users of Ontario hydrometric data. This information is useful in evaluating and planning the hydrometric network. 367 questionnaires were mailed and 205 responses were received which represents a strong response rate and good contact with data users. A breakdown of the user responses according to four user groups, Federal, Provincial, Consultants and Other (including Educational) revealed a good representation from each of the various types of data users.

Important characteristics, concerns and opinions of the users were identified from the response information. The results do not provide the final and complete evaluation of the network by the users nor do the results provide sufficient support for large expenditures or changes to the network without other evidence. The questionnaire results provide one element of the total network evaluation and planning picture.

The questionnaire process served as a useful tool in gaining some more formal type of feedback from the data users. It provided a consistent format for the users to make their concerns and views known to the data collection agencies. It also served to strengthen communication between the users and the data collection agencies. Future projects which involve feedback from the users will be able to build on the information obtained by this questionnaire process.

6.1 User Profile Information

Basic user identification was confirmed for well over two hundred users by the questionnaire survey. This has contributed significantly to a better awareness of the agencies requiring hydrometric data. Ongoing contacts with users through data requests and operational programs also contribute to a better awareness of user community and its needs. It should also be noted that

even though the user community is constantly undergoing changes many of the agencies, companies and individuals have had a long term involvement in the use of hydrometric data which is expected to continue.

When asked to comment on the type of water resources activity involvement the users indicated a wide range of activities. Various types of involvement were indicated by the users including: study and research, design and operation, regulation and forecasting, and related activities such as water quality investigations. In addition many users described other types of activities which were not listed in the questionnaire. The questionnaire results showed that an average of two and one-half different types of activities were indicated for every user. The variation in types of activities causes considerable variation in data needs.

The users' involvement in a wide range of activities was confirmed when the users were asked to comment on the types of projects and/or studies undertaken. The numerous projects mentioned resulted in a list of 33 different topics. Since each of the different topics/activities requires different amounts and types of data the task of summarizing data requirements for all uses is complex.

6.2 Data Uses, Types and Provision

The types of data of main interest to the users were daily discharge and water level data (mean, maximum, and minimum). More than half of the responses indicated a requirement for each of the following types of data: hourly, daily, monthly and annual. Response rates for other types of data were strong although somewhat lower than for the above types (ie. at least one-third of the users for all types). These results give good support to the present priorities for types of data being collected and disseminated.

A strong confirmation concerning the suitability of data was provided from the user responses. Approximately 82 percent of users indicated the data as collected and provided to users is suitable. The remaining 18 percent of users

provided comments concerning shortcomings of some aspects of the data collection program.

Many extensive descriptive comments were provided by the users in response to the question blocks. Many suggestions were provided related to the enhancement of the data collection program from the users' point of view. These suggestions and comments are beneficial information for the management and operation of the data collection program.

Concerning the provision of data to users most users indicated they require the data greater than one month from time of data occurrence. This emphasizes the importance of historical data archival and accessibility. Many users (ie. approximately 25 percent) indicated they require within hours of data collection (ie. "real-time"). Approximately one-half of the users indicated an increasing need for "near-real-time" data acquisition. This gives an indication concerning the changes to be expected in serving the needs of the user community.

The usefulness of data publications as a form of obtaining hydrometric data was confirmed by 81 percent of the users. One-half of the users also obtain data by phone requests. One-third of the users use computer tapes to obtain hydrometric data. Only 9 percent use the microfiche format.

Approximately two-thirds of the users indicated an interest in using interactive computer communications for transfer of data. Many comments and suggestions were provided regarding the provision of data to users. Included were the provision of data through computer communications networks (eg. electronic mail), easier accessibility to data products, and the need for additional information related to the hydrometric stations/basins.

A convincing message was received from the data users concerning changing data needs. The majority of users are experiencing an increasing need for hydrometric data (ie. 63 percent). Very few data users are experiencing decreases in data requirements (ie. only 3 percent). The needs of the remaining group (ie. 34 percent) are not changing significantly or the users chose not to comment. Follow-up with the user community to further define the

changing data requirements may be required.

Many users indicated the importance of accurate, continuous, long-term hydrometric data. Very few users gave a quantitative indication of their requirements in terms of accuracy, continuity or length of record requirements aspects. Generally the users require reasonable confidence in the accuracy of hydrometric data in order to be able to use the quantitative measurements as provided.

In response to a list of types of data analyses by the users an average of 4.9 analysis types per user were indicated. More than one-half of the users indicated application of the following analysis types: Basic statistics (mean, variation, ...), Flow frequency analysis, Rainfall-Runoff modeling, Hydraulic analyses, and Estimation of record at ungauged sites. 24 additional types of analysis were indicated.

The users also indicated extensive use of other related types of data related to hydrometric data. For example approximately 83 percent of the users indicated use of precipitation data. Many users indicated other data such as: snow data, water quality parameters, groundwater, soil moisture. The users also provided a long list of additional types of data including: temperature, humidity, ice data, and land-use land-cover information.

Approximately 44 percent of the users would like to see some data analyses being done by the data collection agencies. 170 suggestions for analyses were made by 91 users. Flow frequency analyses showed the highest number of suggestions (ie. 28). Approximately 37 different types of analysis were suggested by the users. The fact that so many different types of analyses were suggested confirms again the varied activities and needs of the user community.

6.3 Network Requirements

Approximately one-third of the users who responded to the questionnaire indicated critical needs for data within the existing network. The Provincial

group had a response rate of approximately 50 percent and the Consultant group at approximately 13 percent. The task of identifying specific locations was not possible for many users in the Consultant group since data/station needs depend on projects or studies undertaken. In contrast the Conservation Authorities of the province were able to define their needs clearly within their watersheds of jurisdiction. The Federal and Other groups provided detailed site locations in some cases but in many cases general areas were indicated. The feedback information from the users will be useful in documenting hydrometric data usage and in planning future improvements to the network.

When asked to comment on areas of Ontario with insufficient data one-third of the users provided information on areas of need. In total these suggestions covered nearly all of Ontario. This fact that the user community is perceiving a data shortage throughout Ontario is important as an evaluation of the present network and for planning modifications to the network. If only a few small areas with insufficient data had been identified the task of further defining and alleviating the need would be simpler but with a vast area of data need being identified the task is more difficult. Some areas of the Province were identified more often than others as areas with insufficient hydrometric data. Northern Ontario (especially the drainage areas of Hudson and James Bays) was identified by numerous users from each of the four user groups. Small watersheds and urban watersheds were also identified by numerous users.

7. RECOMMENDATIONS

The recommendations contained in this chapter were developed as a response to the extensive feedback information provided from the data users via the questionnaire survey.

7.1 Data User/Client Contacts

a) It is recommended to further develop contacts with data users/clients and improve the knowledge of data user requirements especially in the areas of changing needs (eg. computer communications access to data, increasing needs for hydrometric data). This could be done through several approaches including: client contacts (eg. telephone interviews, information meetings), future data user workshop(s), and by noting data user needs when participating in related workshops, meetings, conferences.

b) It is recommended to maintain the data base of hydrometric data users for Ontario to facilitate a good awareness of user community and any changes taking place. This would include reviewing data requests and data user information from other sources to obtain information regarding changes to the list of users. This would also involve keeping the questionnaire response information for reference.

7.2 Data Analysis and Provision

a) It is recommended to continue the present system of hydrometric data collection. This recommendation is based on a strong support for the suitability of the data being collected and the increasing needs expressed by the users. The system includes collection, processing, archival and provision of hydrometric data. Some data interpretation/analysis work is also included in the present system. The data collection agencies should also expect to experience increasing demands for data and its availability.

b) It is recommended to review workplans and objectives of the data collection agencies with a view to incorporate selected types of analysis suggested by the data user comments. This would be subject to the mandates and resources of the agencies involved. The provision of appropriate analysis products would prove useful to the user community as shown by the questionnaire results.

c) Data compatability and availability with other hydrologic and related types of data should be coordinated with the agencies involved. Many of the users require other types of data in addition to hydrometric data in their studies/analyses. This recommendation could in part be addressed by general information being made more available to the users concerning different data types, sources and availability from the various agencies.

d) It is recommended to improve the provision of hydrometric data to the users by enhancing the service of interactive computer communications, and by provision of general information concerning data availability and information contacts to the general user community. In addition the need to continue with provision of data in microfiche format should be reviewed. Possibly a system to provide data on computer diskettes would be appropriate as a replacement.

7.3 Network Modifications

a) It is recommended to consider an expansion of the network in the areas of: Northern Ontario (ie. particularly Hudson and James Bay watersheds), small hydrologically representative watersheds, and urban watersheds (ie. small watersheds presently urbanized and those undergoing or expected to undergo significant urbanization).

b) It is recommended to further develop maintain a system for documenting hydrometric data/station usage and new requirements. Some of this has been done in various forms by the data collection agencies. The questionnaire responses provide further detailed information in this regard. Data requests from the users over the past several years also provide detailed information.

c) It is recommended to continue coordination of the hydrometric network evaluation and planning process between federal and provincial agencies. This provides an opportunity for major water resources agencies in Ontario (which are also major data users) to have direct involvement in the data collection program. An example is the coordination and exchange of information through the Network Evaluation and Planning Sub-Committee (NEPS). Other data users should be encouraged to discuss their needs with the agencies directly participating in the Canada/Ontario Cost Sharing Agreement for Water Quantity Surveys.

d) It is recommended to incorporate feedback information from data users in the process of planning changes to the network. For example specific information or comments could be requested from users in considering the future monitoring of small or urban or Northern Ontario watersheds.

REFERENCES

(An Annotated list of Example Questionnaire)

A. PLANNING OF A HYDROMETRIC NETWORK FOR THE PROVINCE OF ONTARIO, The Shawinigan Engineering Company Ltd., 1969 for the Inland Waters Branch of the Department of Energy, Mines and Resources.

In this report the point is made that to "assess specific user requirements of the Province of Ontario, an analysis of the future economic development of the Province would have been necessary" (pg. 56) But within the limitations of the contract three major provincial agencies and twelve Universities were contacted.

B. ECONOMIC EVLUATION OF HYDROMETRIC DATA, ACRES Consulting Services Limited, November 1977 for the Inland Waters Directorate.

User interviews were carried out on a Canada wide basis. 65 users were contacted of which 53 indicated the use of hydrometric data (24 in Ontario). 38 written questionnaire responses were received (14 in Ontario). The report includes a telephone interview guide and a list of uses of hydrometric data.

C. WATER RESOURCES BRANCH - DATA DISSEMINATION SUMMARY 1984/85, WRB-Headquarters, December 1985.

The IWD mailing list shows 291 users of the Surface Water Data publication in Ontario (643 for all of Canada). The standard questionnaire asks which publications are required by the user. An additional section asks brief questions each year by theme for example: the use of computer data retrievals, the need for magnetic tape data, the priority of publications.

D. A REGIONAL PROGRAM EVALUATION SYSTEM - ENVIRONMENTAL MANAGEMENT SERVICE - ONTARIO REGION, Environment Canada, March 1979.

Included in this evaluation of the government EMS Program 51-Water Management Data, Ontario Region was a "Questionnaire Evaluating the Effectiveness of Hydrometric Data in Ontario". A survey of a sample of 27 clients was undertaken. Several interviewers carried out the task. The interviewers held meetings to assure consistent interpretation of questions and responses. The questionnaire was primarily program oriented and not data oriented.

E. ONTARIO SEDIMENT SURVEY PROGRAM REVIEW, Conservation Management Systems for Systems for Water Resources Branch, Environment Canada, April/85.

The questionnaire had three parts: A. General, B. Sediment Data Users, C. Sediment Data Collectors. The questionnaires were sent to approximately 95 users. The overall evaluation of user requirements also included a data users workshop.

F. WATER RESOURCES BRANCH - WESTERN AND NORTHERN REGION, HYDROMETRIC NETWORK REVIEW.

This questionnaire had three parts: A. Water Quantity Aspects, B. Sediment Aspects, C. Station Questionnaire. The third part included a listing of all stations operated in the Manitoba and N.W. Ontario District. The third part also include a map of the District with major drainage areas marked and labelled to allow the user to identify station locations from the WRB station code (see figure 1).

G. HYDROLOGIC NETWORK ASSESSMENT FOR NOVA SCOTIA, Jointly prepared by Environment Canada and Department of the Environment for Nova Scotia, 1985.

Data user questionnaires were sent to 151 users of which 109 responded of which 71 responded in detail and 38 were not interested. Maps were provided with the questionnaire for user responses. An extensive list of data use purposes was part of the questionnaire.

H. SURFACE WATER DATA IN THE ATLANTIC REGION, Water Resources Branch Atlantic Region, Environment Canada, brochure 1985.

This information brochure describes: the data/information available from the Water Resources Branch, a summary of past data request patterns, a flowchart of the data collection system, a map of the Atlantic Region showing discharge, water level and sediment stations. The brochure also includes a brief questionnaire which asks for user identification, publications/products requirements, potential use of a water conditions report, and need for real time data (ie. 6 to 8 hours after being recorded).

I. SUMMARY OF DATA REQUESTS 1982/83, Water Resources Branch - Ontario Region.

This type of summary report on data requests is regularly prepared by the various WRB Regional offices. These reports describe past data requirements of the users as measured by specific requests for data (not publications). These report provide very useful information but do not

provide a complete review of all data used. For example various users may refer to publications kept in various reference centres and this would not be known or recorded as a data request. In the design of any subsequent questionnaire the information that is already available through these reports should be considered.

J. CURRENTS OF CHANGE - FINAL REPORT, Inquiry on Federal Water Policy.

Included in this report is a listing of references for 313 written briefs and 201 oral presentations made during this Inquiry. Hearings were held from September 18, 1984 to December 16, 1984. Several research papers and other documents are also referenced in this final report.

APPENDIX A

EXAMPLE DATA USER QUESTIONNAIRE

Environment Canada | Environnement Canada
Environmental Conservation | Conservation de l'environnement

75 Farquhar Street
Guelph, Ontario
N1H 3N4
(519) 821-0110

September 30, 1986

Your file Votre référence

Our file Notre référence

Dear Sir or Madame:

The purpose of this letter is to request information about your requirements for Ontario streamflow and water level data. If you use or plan to use this type of data, your response to the enclosed questionnaire would be greatly appreciated. Also, please consider forwarding a copy of the questionnaire to any colleagues who may be interested in responding. If a questionnaire has been sent to other people in your organization, a list of their names is attached. A French version of the questionnaire will be provided on request. The questionnaire has been distributed to approximately three hundred users and potential users of Ontario streamflow and water level data.

Under the terms of the Canada/Ontario Cost Share Agreement on Water Quantity Surveys, Environment Canada, the Ontario Ministry of Natural Resources, the Ontario Ministry of the Environment, and Ontario Hydro collaborate in collecting streamflow and water level data at 433 hydrometric stations in Ontario. Data are collected outside of the Agreement by various agencies at an additional 126 stations. Data for each station are available on request.

In support of the Agreement, a Network Evaluation and Planning Sub-Committee coordinates and conducts studies to identify opportunities for improving the hydrometric network. The Sub-Committee is reviewing present and future requirements for Ontario streamflow and water level data. Better knowledge of the data requirements will assist in identifying any deficiencies or redundancies in the hydrometric network. This will ultimately result in a network which can better meet the requirements of our data users, including you and/or your agency.

The Sub-Committee would like to receive the completed questionnaires by October 31, 1986. A self-addressed return envelope is enclosed for your convenience. Please contact me or another Sub-Committee member if you would like to discuss the questionnaire:

Mac Odell	Ontario Ministry of Natural Resources	416-965-1271
Brian Whitehead	Ontario Ministry of the Environment	416-965-6194
Charlie Stevens	Ontario Hydro	416-592-4187

Thank you for your consideration of this request.

Yours truly,

Robert B. Phinney, P. Eng.
Chairman, Network Evaluation and Planning Sub-Committee

Canada

In order to conserve energy and resources, this paper contains post-consumer fibre.

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SEPTEMBER 1986

HYDROMETRIC DATA USER QUESTIONNAIRE FOR ONTARIO

Sponsored by: Network Evaluation and Planning Sub-Committee
Canada-Ontario Cost Sharing Agreement for Water Quantity Surveys

Contacts:	Bob Phinney	Environment Canada	(519) 821-0110
	Brian Whitehead	Ontario Ministry of the Environment	(416) 965-6194
	Mac Odell	Ontario Ministry of Natural Resources	(416) 965-1271
	Charlie Stevens	Ontario Hydro	(416) 592-4187

User Identification: Is the information on the mailing label below correct? ___
(Attach a business card if you wish)

Name: _____

Position/Title: _____

Agency: _____

Address: _____

Phone Number: _____

Please indicate the type(s) of water resources activity your agency is involved in:

Type of Water Resources Activity

Design of Water Resource Structures/Equipment..... _____

Water Resources Regulation/Operation..... _____

Water Quality Investigations/Monitoring..... _____

Flow Forecasting & Flood Warning..... _____

Water Related Studies/Research..... _____

Other (Please specify) _____

_____

If possible, please send information material/brochure which describes your organization when returning this questionnaire.

Please list the water resource projects/studies which your agency has carried out or has planned which require hydrometric data. If possible, identify any reports which have been prepared on these activities._____

_____

_____

_____

_____

_____

_____

Type(s) of data used or required:

Hourly_____ Mean_____ Discharge_____ Ice Thickness_____

Daily_____ Maximum_____ Water Level_____ Velocity_____

Monthly_____ Minimum_____ Sediment_____ Cross-section_____

Annual_____ Instantaneous_____ Rating Curves_____ Water temperature_____

Other_____

Is the type of data being collected suitable for your purposes? Comments?

_____

_____

Within what time frame(s) after occurrence do you require data?

within hours_____one day_____one week_____one month_____longer_____

Do you have an increasing need for "near-real-time data" acquisition?_____

_____

Which form of obtaining hydrometric data do you use?

Publication_____Computer tape_____Phone request_____Microfiche_____

Are you using or interested in using interactive computer communications for the transfer of data?_____

_____

Do you have any comments or suggestions for enhancement to the present system of supplying data to users?_____

_____

Does your organization carry out streamflow, water level, or other water measurements?

_____

Are your requirements for hydrometric data increasing?_____ decreasing?_____

Comments?_____

_____

If possible please comment on your data needs regarding accuracy, length of record, continuity of data._____

_____

What kind of data analysis do you carry out:

Basic statistics (mean, variation,...)_____ Flow Duration Analysis_____

Flow frequency analyses_____ Correlation of stations_____

Rainfall-Runoff modelling_____ Determine Dependable Flows_____

Hydraulic analyses_____ Determine Unit Hydrographs_____

Estimation of record at ungauged sites_____

Other_____

_____

What other types of data do you use in projects involving streamflow data?

precipitation_____ groundwater_____ snow_____

soil moisture_____ water quality parameters_____

other_____

What type(s) of data interpretation or analyses would you like to see being done by the agencies collecting and disseminating the data. (For examples see analysis types above)_____

_____

_____

_____

Please refer to the attached map included in this package when responding to the following items. (Mark on the map or attach other information if you wish)

Do you have a critical need for hydrometric data of specific stations in the existing network? Please list below or attach a list._____

_____

_____

_____

_____

_____

Please identify any areas of Ontario which have insufficient hydrometric data for your purposes. If possible, also indicate the amount and type(s) of data required.

_____

_____

_____

_____

Please indicate further information, references or suggestions which would assist in the evaluation and planning of the Ontario network._____

_____

_____

_____

Do you wish to receive additional information on the collection of water quantity data in Ontario? (eg. map of hydrometric stations in Ontario (1986 edition))_____

_____

_____

Please attach additional comments or documents if you wish.

Thank you for completing this questionnaire.

ONTARIO REFERENCE MAP

DRAFT HYDROMETRIC DATA USER QUESTIONNAIRE

(Please mark on the map and/or check off the boxes below)

Map from: Atlas - Water Quantity Resources of Ontario, OMNR

20.1 Drainage Basins

Hudson	☐	Erie	☐
Nelson	☐	Ontario	☐
Superior	☐	Ottawa	☐
Huron	☐	Outside Ontario	☐

Indicate areas where hydrometric data required.

APPENDIX B

MAILING LIST OF HYDROMETRIC DATA USERS

1003	Robinson	Great Lakes St. Lawr. Study Of	Environment Canada	Water Planning & Management Bran	Cornwall
1004	Kitchen		Environment Canada	Parks Canada	Peterborough
1006	Shikaze		Environment Canada	Conservation & Protection, Ontar	Toronto
1010	Copeland	Officer-in-Charge, WRB	Environment Canada	Water Resources Branch	North Bay
1011	Bishop	Officer-in-Charge, WRB	Environment Canada	Water Resources Branch	Thunder Bay
1013		Superintendant Rideau Canal	Environment Canada	Parks Canada	Smiths Falls
1016	Wagner	Regional Director - Ontario Re	Environment Canada	Inland Waters Directorate	Burlington
1017	Bathurst		Environment Canada	Water Planning and Management Br	Hull
1019		Head, Data Systems Section	Environment Canada	Water Quality Branch	Hull
1020	Laporte		Environment Canada	Parks Canada	Ottawa
1022	Rowe	Officer-in-Charge, WRB	Environment Canada	Water Resources Branch	Ottawa
1024	Cuthbert	Regional Chief	Environment Canada	Water Planning and Management Br	Burlington
1025	McLaurin	Regional Hydrologist	Environment Canada	Water Resources Branch	Winnipeg
1026	Dick	Hydraulics Division	Environment Canada	National Water Research Institut	Burlington
1026		Director, Climatological Appli	Environment Canada	Canadian Climate Centre	Downsview
1027	Kamp	Regional Chief	Environment Canada	Water Resources Branch	Guelph
1027		Director	Environment Canada	National Hydrology Research Inst	Saskatoon
1028	Philbert	Regional Chief	Environment Canada	Water Quality Branch, Ontario Re	Burlington
1028		Director	Environment Canada	National Water Research Institut	Burlington
1029	Dowdeswell	Regional Director General	Environment Canada	Ontario Region	Toronto
1029			Environment Canada	Canadian Wildlife Service, Ontar	Ottawa
1030	Slater	Director	Environment Canada	IWD - Research Co-ord. & Program	Hull
1030	Allsopp	Chief Scientific Services	Environment Canada	AES - Ontario Region	Toronto
1031	Cameron	Manager, National Capital Area	Environment Canada	Conservation and Protection	Ottawa
1032	Planck	Habitat Biologist	Environment Canada	Canadian Wildlife Service	London
1033	Perks	Chief, Hydrology Division	Environment Canada	Water Resources Branch	Hull
1034	Boughen		Environment Canada	Communications Branch	Toronto
1040	Kimmett	Director, Water Resources Bran	Environment Canada	Water Resources Branch	Hull
1200	Walden		Lake of the Woods Secretariat		Hull
1201	McLaughlin		Ottawa River Regulation Secretariat		Hull
1500	Ashton	Project Manager	Public Works Canada	Northwestern Ontario	Thunder Bay
1501	Beauchamp	Chief Bridge Engineer	Public Works Canada		Ottawa
1502	Lawrie	Chief Waterways Development	Transport Canada	Canadian Coast Guard	Ottawa
1503	Chapman		Energy Mines and Resources	Surveys and Mapping	Ottawa
1504	Clamen	Engineering Advisor			Ottawa
1505	Coote		Agriculture Canada	Land Resources Research Institut	Ottawa
1506		Librarian	National Capital Commission	Library	Ottawa
1511	Mitchell	Head Tidal Predictions	Fisheries and Oceans	MEDS	Ottawa
1512		Government Documents	National Library of Canada	Canadian Acquisitions Division	Ottawa
1513	Presslaber	Resource Centre	Energy Mines and Resources Canada	Topographical Survey Division R	Ottawa
1514	St.Jacques	Regional Tidal Officer	Canadian Hydrographic Service	Central Region	Burlington
1515	Graham		St. Lawrence Seaway Authority		Cornwall
1516	Tait	Chief	Canadian Hydrographic Service	Tides Currents & Water Levels	Ottawa
1517	Terroux		Energy Mines and Resources Canada	Surveys & Mapping Branch	Ottawa
1520	Schilder	Hydrologist	Dept. of Indian and Northern Affairs		Ottawa
1521	Waroway		Dept. Indian and Northern Affairs	Water Resources Division	Hull
1523	Nicolsen		Canadian Forestry Service	Great Lakes Forest Research Cent	Sault Ste. Marie
1524	Thompson		Agriculture Canada	Regional Development Branch	Toronto
1525	Findlay		Agriculture Canada	Harrow Research Station	Harrow
1526	Wall		Agriculture Canada	Land Resource Science	Guelph
1527	Acton		Agriculture Canada	Guelph Agriculture Centre	Guelph
1528	Meek		Agriculture Canada	Regional Development Branch	Toronto
1529	Achlemichuk		Fisheries & Oceans Canada	Sea Lamprey Control Centre	Sault Ste. Marie
2003	Drennan		Ministry of Natural Resources	Eastern Region	Kemptville
2007	Paradis		Ministry of Natural Resources	Northern Region	Timmins
2013	Campbell		Ministry of Natural Resources		London

2014	Gryniewski	Sup. Streamflow Forecast Centr	Ministry of Natural Resources	Cons. Auth. & Water Man. Branch	Toronto
2015	Jordan		Ministry of Natural Resources	North-eastern Region	Sudbury
2016	Kavcic		Ministry of Natural Resources		London
2017	Kurtz		Ministry of Natural Resources	Central Region	Richmond Hill
2018	Stephen	Engineer	Ministry of Natural Resources		Huntsville
2019	Reckhahn	Research Scientist	Ministry of Natural Resources		Tehkummah
2020		Regional Engineer	Ministry of Natural Resources	North-Central Region	Thunder Bay
2022	Tippett		Ministry of Natural Resources		Owen Sound
2023	Odell		Ministry of Natural Resources	Cons. Auth. & Water Man. Branch	Toronto
2024	Chang		Ministry of Natural Resources	Cons. Auth. & Water Management B	Toronto
2025	Corry	Superv., Water Level Control S	Ministry of Natural Resources	Algonquin Region	Huntsville
2026	Vine		Ministry of Natural Resources		Bancroft
2026	Pesant	Chief Water Quality & Quantity	Environment Canada	Quebec Region	Longueuil
2200	Adams		Napanee Region Conservation Authority		Napanee
2201	Bonnis		Nickel District Conservation Authority		Sudbury
2203	Damario		Niagara Peninsula Conservation Authority		Allanburg
2205	Elston		Ausable Bayfield Conservation Authority		Exeter
2206	Gold		Upper Thames R. Conservation Authority		London
2208	Graves		Catfish Creek Conservation Authority		Aylmer
2210	Jarrett		Metrop. Toronto & Reg. Cons. Auth.		Downsview
2216	Macnab	General Manager	Kawartha Region Conservation Authority		Fenelon Falls
2218	Merriam		Otonabee Region Conservation Authority		Peterborough
2219	Minshall		Grand River Conservation Authority		Cambridge
2222	Plessl		Hamilton Region Conservation Authority		Ancaster
2223	Reid		Rideau Valley Conservation Authority		Manotick
2225	Suke		Lakehead Region Conservation Authority		Thunder Bay
2226	Taylor		Maitland Valley Conservation Authority		Wroxeter
2227	Taylor		Essex Region Conservation Authority		Essex
2228	Tufqar		Halton Region Conservation Authority		Milton
2230	Beckett		North Bay Mattawa Conservation Auth.		North Bay
2231	Code		Raisin Region Conservation Authority		Martintown
2232	English	Water Management Supervisor	Cataraqui Region Conservation Authority		Glenburnie
2233		General Manager	Saugeen Valley Conservation Authority		Hanover
2234		General Manager	Mississippi Valley Conservation Auth.		Lanark
2235	Gourley	Manager Water Resources	Credit Valley Conservation Authority		Meadowvale
2236	Hughes		St. Clair Region Conservation Auth.		Strathroy
2237	Kao	Assistant General Manager	Grand River Conservation Authority		Cambridge
2238			Long Point Region Conservation Auth.		Simcoe
2242	Pols	Planning & Info. Coordinator	Mattagami Region Conservation Auth.		Timmins
2243		Resource Manager	Crowe Valley Conservation Authority		Marmora
2244	Roth		Lower Thames Valley Conservation Auth.		Chatham
2245	Rutherford	Chief Administrative Officer	Ganaraska Region Conservation Authority		Port Hope
2247		General Manager	South Lake Simcoe Conservation Auth.		Newmarket
2248	Eaton		South Nation Conservation Authority		Berwich
2249			Nottawasaga Valley Conservation Auth.		Angus
2250			Central Lake Ontario Conservation Auth.		Whitby
2251			Kettle Creek Conservation Authority		St. Thomas
2252			Lower Trent Region Conservation Auth.		Trenton
2253			Moira River Conservation Authority		Belleville
2254			North Grey Region Conservation Auth.		Owen Sound
2255			Prince Edward Region Conservation Auth.		Picton
2256			Sauble Valley Conservation Authority		Owen Sound
2257			Sault Ste. Marie Region Conserv. Auth.		Sault Ste. Marie
2500	Logan	Chief, Hydrology & Networks Un	Ontario Ministry of Environment	Water Resources Branch	Toronto
2501	Onderdonk	Manager	Ontario Ministry of Environment	Hazardous Contaminants Coordinat	Toronto
2502	Scott	Coordinator	Ontario Ministry of Environment	Acid Precipitation Office	Toronto

2503	Salbach	Assistant Director	Ontario Ministry of Environment	Waste Management Branch	Toronto
2504	Dillon	Supervisor	Ontario Ministry of Environment	Limnology Unit	Dorset
2505	Ralston	Manager	Ontario Ministry of Environment	Water Resources Branch	Toronto
2506	Fleischer	Manager	Ontario Ministry of Environment	Water Resources Branch	Toronto
2507	Roberts	Manager	Ontario Ministry of Environment	Water Resources Branch	Toronto
2508	Armstrong	Manager	Ontario Ministry of Environment	Env. Approvals and Landuse Plann	Toronto
2509	Lammers	Chief	Ontario Ministry of Environment	Toronto Regional Office	Toronto
2510	Roy	Chief	Ontario Ministry of Environment	Sudbury Regional Office	Sudbury
2511	Vander Wal	Chief	Ontario Ministry of Environment	Thunder Bay Regional Office	Thunder Bay
2512	German	Chief	Ontario Ministry of Environment	Kingston Regional Office	Kinston
2513	Veal	Chief	Ontario Ministry of Environment	London Regional Office	London
2514	Irwin	Chief	Ontario Ministry of Environment	Hamilton Regional Office	Hamilton
2517	Hicks		Ontario Ministry of Environment	Cambridge District Office	Cambridge
2800	Carter		Min. of Transportation & Communications	Highway Design Office West Bldg.	Downsview
2801	Driver	Guelph Agriculture Centre	Ontario Ministry of Agriculture & Food	Soil & Water Management Branch	Guelph
2802	Harris		Min. of Transportation & Communications	Hydrology Section	Downsview
2803	Moore		Ontario Ministry of Agriculture & Food		Lindsay
2804	Lang		Ontario Ministry of Agriculture & Food	Grand River Conservation Authori	Cambridge
2805	Johnston		Ontario Ministry of Agriculture & Food	Capital Improvement Branch	Toronto
2806	Lane		Min. of Transportation & Communications		Kingston
2809	Crawford		Ontario Ministry of Energy		Toronto
2810		Government Publications Sectio	Ontario Legislative Library	Technical Services & Systems	Toronto
2900	Stevens	Engineer - River Control	Ontario Hydro	Civil Works	Toronto
2901	Taylor	Manager, Geotech. & Hydraul. E	Ontario Hydro		Toronto
2902	Harris	Manager - Resource Utilization	Ontario Hydro		Toronto
2903	Doyle	Manager - Civil Works	Ontario Hydro		Toronto
2904	Taylor	Chief Librarian	Ontario Hydro		Toronto
2905	Walton	Operations Manager	Ontario Hydro	Central Region	Willowdale
2906	Lynch	Operations Manager	Ontario Hydro	Eastern Region	Belleville
2907	Davidson	Manager, Distrib. Systems & Op	Ontario Hydro	Georgian Bay Region	Barrie
2908	Graham	Operations Manager	Ontario Hydro	Northeastern Region	North Bay
2909	Buitenhuis	Operations Manager	Ontario Hydro	Northwestern Region	Thunder Bay
2910	Wicks	Operations Manager	Ontario Hydro	Western Region	London
2911	Complak		Ontario Hydro	Dobson Research Lab	Toronto
2912	Welhams		Ontario Hydro	Environmental Studies and Assess	Toronto
3000	Eichenbaum		City of Burlington	P.W. Dept.	Burlington
3002	Becking	Coordinator Emergency Measures	Regional Municipality of Ottawa Carleton		Ottawa
3003	Balacko		Community Health Programs		Winnipeg
3004	Brown		Manitoba Environment	Env. Management Services Branch	Winnipeg
3008	Yateman	Clerk Treasurer	Township of Rama		Washago
3009	Barry	Environmental Research Branch	Atomic Energy of Canada Limited	Chalk River Nuclear Laboratories	Chalk River
3010	Manley		Public Utilities Commission		Peterborough
3011		Sewers Engineer	City of Windsor	Public Works Department	Windsor
3500	Watt		Queens University	Department of Civil Engineering	Kingston
3501	Bardecki		Ryerson Polytechnical Institute	School of Applied Geography	Toronto
3503	McGinn		Brandon University	Department of Geography	Brandon
3504	Morgan		Ryerson Polytechnical Institute		Toronto
3506	Adams	Associate Professor	University of Toronto	Department of Civil Engineering	Toronto
3507	Barton	Coordinator Municipal Section	Royal Military College	Department of Civil Engineering	Kingston
3508	Buttle		Trent University	Department of Geography	Peterborough
3509	Cogley		Trent University	Department of Geography	Peterborough
3510	Davis	Office of the Dean	University of Western Ontario	Faculty of Engineering Science	London
3512	Flosznik	Supervisor	York University	Teaching Resource Centre	Downsview
3513	Gardner		University of Waterloo	Department of Geography	Waterloo
3514	James	Professor	McMaster University	Department of Civil Engineering	Hamilton
3515	Johnson		University of Ottawa	Geography Department	Ottawa

3516	Kramer		McMaster University	Geology Department	Hamilton
3517	Lagarec		University of Ottawa	Department of Geography	Ottawa
3518	Leith		York University	Department of Natural Science	Downsview
3523	Luckman		University of Western Ontario	Department of Geography	London
3524	Tinkler		Brock University	Department of Geography	St. Catharines
3525	McBean		University of Waterloo	Department of Civil Engineering	Waterloo
3526	Phillips	Associate Professor	Lakehead University	Department of Geography	Thunder Bay
3528	Roulet		York University	Department of Geography	Downsview
3529	Schiller		University of Ottawa	Department of Civil Engineering	Ottawa
3531	Subins		Wilfrid Laurier University	Department of Geography	Waterloo
3532	Taylor		Trent University	Department of Geography	Peterborough
3535	Vandall	Map Library	University of Windsor	Department of Geography	Windsor
3536	Watts		Sir Sandford Fleming College	Geology Department	Lindsay
3537	Woo		McMaster University	Department of Geography	Hamilton
3539	Solomon		University of Waterloo	Department of Civil Engineering	Waterloo
3540	Dickinson		University of Guelph	Department of Civil Engineering	Guelph
3541	Martini	Ontario Agricultural College	University of Guelph	Department Land Resource Science	Guelph
3542	Adamowski		University of Ottawa	Dept. of Civil Engineering	Ottawa
3543	Townsend		University of Ottawa	Dept. of Civil Engineering	Ottawa
3544	Wisner		University of Ottawa	Dept. of Civil Engineering	Ottawa
3545	Smith		McMaster University		Hamilton
3546	Whitely		University of Guelph	School of Engineering	Guelph
3547	Spence		York University	Dept. of Geography	Downsview
3548	Cifarelli		University of Toronto	Department of Geography	Toronto
3549	Drinkwater		Bedford Institute		Dartmouth
3550	Madramootoo	Assistant Professor	MacDonald College of McGill University	Department of Agricultural Engin	Ste. Anne DeBell
3551	Pysklyavic		Loyalist College		Belleville
3552	Irwin		University of Guelph	School of Engineering	Guelph
4000			Kilborn Engineering Limited		Toronto
4001			S.A. Kircheffer Limited	Consulting Engineer & Planner	Sudbury
4002			Golder Associates		Mississauga
4003			Lanmer Consultants Limited	Planning Engineering	Niagara Falls
4004			R.J. Long Consulting Limited		Orangeville
4005			MacLaren Engineers Inc.	Division of Lavalin	Toronto
4006	Paine		J.D. Paine Engineering Inc.		Kingston
4007			Proctor & Redfern Limited	Consulting Engineers	Don Mills
4008			Simcoe Engineering Limited		Pickering
4009	Odom		Beak Consultants Limited		Mississauga
4010			D.H. Braun Consulting Engineers Ltd.		Guelph
4011	Shannon		Canviro Consultants Limited	Environmental Engineering	Kitchener
4012			Cumming-Cockburn & Associates Ltd.	Consulting Engineers	Waterloo
4013			Cumming-Cockburn & Associates Ltd.	Consulting Engineers	Willowdale
4014			M.M. Dillon Limited		Willowdale
4015			Ecoplans Limited	Environmental Planning	Waterloo
4016			Gamsby and Manerow	Consulting Engineers	Owen Sound
4018	Anderson		B.M. Ross & Associates Ltd.		Goderich
4019	Arbuckle		R.E. Clipsham Limited		Georgetown/Halto
4020	Balinski		Peach, Mandazena, Barnsley	& Balinski Inc.	Thorold
4021	Batten		Kleinfeldt Consultants Ltd.		Brampton
4022	Bishop		Marshall Macklin Monaghan Limited		Don Mills
4023	Bowa		Oliver Mangione McCalla	& Associates Ltd.	Nepean
4024	Brodie		Andrew Brodie Associates Inc		Thornhill
4025	Brummell		Skelton Brummell & Associates Inc.		Barrie
4026	Campbell		R.V. Anderson Associates Ltd.		Willowdale
4027	Chow		R.E. Winter & Associates Ltd.		Mississauga
4028	Cripps		Philips Planning & Engineering Ltd.		Burlington

4029	Clement	UMA Engineering Ltd.		Ottawa
4033	Elliott	D.F. Elliott Consulting Engineers Ltd.		New Liskeard
4034	Garraway	Garatech Inc.		Brampton
4035	Gibson	Barker Torp Gibson Limited	Consulting Engineers	Don Mills
4036	Giles	C.C. Parker Consultants		Hamilton
4037	Goel	Toronto Inspection & Testing Serv. Inc.		Markham
4038	Gorrie	Paragon Engineering Limited		Kitchener
4039	Gupta	G.M. Sernas & Associates Ltd.		Toronto
4040	Harsch	K. Smart Associates		Kitchener
4041	Hayworth	Project Planning Limited		Toronto
4043	Jobin	A.J. Robinson & Associates Ltd.		Kanata
4044	Johansen	F.J. Reinders & Assoc. Canada Ltd.		Brampton
4045	Kimble	Cosburn Patterson Wardman Ltd.		Markham
4046	Li	Hoddenbagh Horton & Associates Ltd.		Whitby
4048	McNalty	Ainley and Associates Limited		Collingwood
4049	Marucelj	Totten Sims Hubicki Associates		Cobourg
4050	Maunder	Paul Theil Associates Ltd.		Bramalea
4052	Ng	Walter Fedy McCarger Hachborn		Kitchener
4055	Rohacek	Reid and Associates Limited		Barrie
4057	Sbrocca	Lafontaine Cowie Buratto & Assoc. Ltd.		Windsor
4059	Schwarz	Conestoga-Rovers & Associates Ltd.		Waterloo
4060	Steeves	Airmap Ltd.		Ottawa
4062	Walters	Giffels Associates Limited		Rexdale
4063	Wiebe	J. Bryon Wiebe Ltd.		Simcoe
4064	Yaeger	Delcan DeLeuw Cather Canada Ltd.		Don Mills
4065	Judge	Acres Consulting Services Limited		Niagara Falls
4066	Banks	Morrison Beatty Limited		Mississauga
4067	Carter	Totten Sims Hubicki Assoc.		Whitby
4068	Coleman	Ecologistics Ltd.	Westmount Place	Waterloo
4070	Cunningham	Essa Ltd.		Toronto
4071	Hansen	Ducks Unlimited	Provincial Office	Barrie
4072		Envirosearch Ltd.		Rockwood
4073		Gammarus Assoc.		Peterborough
4074	Hill	Acres International Limited		Niagara Falls
4077		Kostuch Engineering Ltd.		Brockville
4078	Lathem	Lathem Group		Richmond Hill
4080		Fenco Engineers	Library	Toronto
4082	Lishman	Kostuch Engineering Ltd.		Gloucester
4083		M.M. Dillon Ltd.		London
4084	Osmond	Gartner Lee Assoc. Ltd.	Toront Buttonville Aire	Markham
4085	Palmer	Gore & Storrie Ltd.		Toronto
4088	Smith	Gore & Storrie Ltd.	Consulting Engineers	Ottawa
4089	Cummings	Smith-Hoffman Associates		Guelph
4090	Stidwill	Stidwill & Assoc. Ltd.		Cornwall
4091		Environmental Applications Group Ltd.		Toronto
4093		W.F. Baird & Assoc.	Coastal Engineers	Ottawa
4094	Westerby	Monenco Ltd.		Rexdale
4095		Geocan Consulting Engineers		Rexdale
4096	Hunter	Airphoto Analysis & Assoc.	Consulting Engineers	Toronto
4097		R.B. Anderson Associates Ltd.		Welland
4098		Bird & Hale Limited		Toronto
4099		E.A. Bishop Associates Ltd.		Toronto
4100	DeCarvalha	R.J. Burnside & Associates		Orangeville
4101	Collins	Ducks Unlimited (Canada)		Aurora
4102		U.B. Cork Co. Ltd.	Consulting Engineers	Thunder Bay
4103		Foster Engineering Ltd.		Toronto

4104			Hunter & Associates		Toronto
4105			Indecon Consultants Ltd.		Willowdale
4106			International Environmental Cons. Ltd.		Islington
4107			Kimberly-Clark of Canada Ltd.		Toronto
4108			Kresin Engineering & Planning		Sault Ste. Marie
4109			W.P. London & Associates Ltd.	Consulting Engineers	Niagara Falls
4110			Monteith & Sutherland Ltd.	Consulting Engineers	Petrolia
4111			Northland Engineering		North Bay
4112			J.L. Richards & Associates Ltd.		Ottawa
4113			Rupke & Associates		Bradford
4114			Shawinigan Engineering Co. Ltd.		Montreal
4115			Shawinigan Engineering Co. Ltd.		Toronto
4116			Shawinigan Engineering Co. Ltd.		Mississauga
4117			Galt Energy Systems Ltd.		Cambridge
4118			Rand Engineering Corporation	Mississauga Executive Centre	Mississauga
4119	Preley		W.L. Wardrop & Associates Ltd.	Engineering Consultants	Thunder Bay
4120			Albery, Pullirits, Dickson & Assoc. Ltd.		Don Mills
4121	Robertson		Teck Corporation		Vancouver
4122	Fuhrmann		SNC W.P.London & Associates Ltd.		Niagara Falls
4123	Graham		J.E. Hanna Associates		Pickering
4124	McVey		McVey Engineering		Niagara Falls
4125	Buckrell		Proctor & Redfern Ltd.		Thunder Bay
4127	Bonsteel		Pollutech Ltd.		Oakville
4128	Lackey		Triton Engineering Services Ltd.	Consulting Engineers	Orangeville
4129	Carter		Electrogen Corporation		Norval
4131	Glaycier		Walker Engineering		Sault Ste. Marie
4132			Dick Consulting Service		Toronto
4133	Beak	Consulting Biologist			Ottawa
4136			Dames - Moore Consultants		Toronto
4140	Green		Conservation Management Systems	Consultants in Soil Cons. & Wate	Waterloo
4600	Atkins				London
4601	Dawdy				North Bay
4602	Boals				Orleans
4603	Bryck				Thornhill
4604	Clark				Ottawa
4605	Kleinschmidt				Waterloo
4606	Leishman				Kitchener
4607	Owen				Ottawa
4608	Ozga				London
4609	Bergman				Winnipeg
4610	Schantz				Walkerton
4611	Troyale				Kitchener
4612	Bird				Toronto
4613	Cherchuk, P.Eng				Toronto
4614	Yee				Toronto
4615	Trich	Consultant			Clinton
4617	Nechols				Mississauga
4618	Kuiper				Brantford
4619	Nixon				Sarnia
4620	Gundry				Waterloo
4800	Agnew	Barrister & Solicitor			Thornhill
4801	Bolger		Inco Environmental Control Dept.	General Engineering Bldg.	Copper Cliff
4802	Corning		Centre Wellington DHS		Fergus
4803	Denning		Lambton Industrial Society		Sarnia
4804	Lepine		Allied Chemical		Amherstburg
4805			Polar Gas Project	Library	Toronto

4806		Great Lakes Region Office	International Joint Commission		Windsor
4807	Martin		Willis Cunliffe Tait Delcan		Ottawa
4808	Philip		Armbro Construction		Brampton
4809	Reinsborough		Abitibi Price Inc	Research Centre	Mississauga
4810			Renfrew Hydro		Renfrew
4811	Seif	Coordinator Environmental Serv	PetroCanada		Don Mills
4812			Structural Section		London
4813	Symington		Great Lakes Power Ltd.		Sault Ste. Marie
4814	Vivyurka		Rio Algom Ltd.		Elliot Lake
4815	Adam		Interdisciplinary Systems Ltd.		Winnipeg
4816	Clements	Technical Control Supervisor	Domtar Packaging Section		Trenton
4817	Lester		Royal Ontario Museum	Dept. of Ethnology	Toronto
4818			Save Our Streams Inc.		Islington
4819	Tovell		Royal Ontario Museum	Department of Mineral & Geology	Toronto
4820	Kierans		Grand Canal Company Ltd.		St. John's
4822	Lamoureux	Conserv. & Coord. of Education	Royal Botanical Gardens		Hamilton
4823	Narsh		Domtar Ltd.		Seneville
4825	Jones		MIE Marine Ltd.		Toronto
4826	Marshall		Trans Canada Pipeline		Toronto
4828	Rodriguez		Fred Schaeffer & Assoc.		Downsview
4829	Childs		Bolter, Parish, Terimble		Edmonton
4830	Copland		C E D S I		Mississauga
4831			Greer, Galloway & Associates		Belleville
4832			Gregg Edens Limited		Toronto
4833			Bunting Wardman Ltd.		Willowdale
4900	Clark	Buffalo District	U.S. Department of the Army	Corps of Engineers	Buffalo
4901	Pratt	Brigadier General	U.S. Department of the Army	C.O.E. North Central Division	Chicago
4902	Wilshaw	Detroit District	U.S. Department of the Army	Corps of Engineers	Detroit
4904	Thomas	Hydrologist	U.S. Geological Survey	Water Resources Division	Reston
4905	Croley II	Great Lakes Environ. Research	National Oceanic & Atmospheric Admin.	Department of Commerce	Ann Arbor
4907	Chasson		Northwoods Audubon Centre		Sandstone

APPENDIX C

LIST OF DATA USERS RESPONDING TO THE QUESTIONNAIRE

LIST OF HYDROMETRIC DATA USERS
RESPONDING TO QUESTIONNAIRE

1002	Martel	Environment Canada	Longueuil
1003	Robinson	Environment Canada	Cornwall
1004	Kitchen	Environment Canada	Peterborough
1006	Shikaze	Environment Canada	Toronto
1013	O'Dell	Environment Canada	Smiths Falls
1017	Bathurst	Environment Canada	Hull
1019	Brooksbank	Environment Canada	Hull
1024	Cuthbert	Environment Canada	Burlington
1025	McLaurin	Environment Canada	Winnipeg
1026	Mackay	Environment Canada	Saskatoon
1027	Colwell	Environment Canada	Downsview
1028	Philbert	Environment Canada	Burlington
1029	Carreiro	Environment Canada	Ottawa
1030	Allsopp	Environment Canada	Toronto
1031	Cameron	Environment Canada	Ottawa
1033	Perks	Environment Canada	Hull
1041	Beltaos	Environment Canada	Burlington
1200	Walden	Lake of the Woods Secretariat	Hull
1201	McLaughlin	Ottawa River Regulation Secretariat	Hull
1503	Terroux	Energy Mines and Resources Canada	Ottawa
1504	Clamen	International Joint Commission	Ottawa
1504	Dolan	International Joint Commission	Windsor
1505	Coote	Agriculture Canada	Ottawa
1511	Achlemichuk	Fisheries & Oceans Canada	Sault Ste. Marie
1511	Mitchell	Fisheries and Oceans	Ottawa
1514	Tait	Canadian Hydrographic Service	Ottawa
1514	St.Jacques	Canadian Hydrographic Service	Burlington
1515	Graham	St. Lawrence Seaway Authority	Cornwall
1520	Schilder	Dept. of Indian and Northern Affairs	Ottawa
1520	Dodps	Dept. of Indian & Northern Affairs	Toronto
2003	Drennan	Ministry of Natural Resources	Kemptville
2014	Gryniewski	Ministry of Natural Resources	Toronto
2016	Kavcic	Ministry of Natural Resources	London
2017	Kurtz	Ministry of Natural Resources	Richmond Hill
2018	Stephen	Ministry of Natural Resources	Huntsville
2019	Reckahn	Ministry of Natural Resources	Maple
2020	Adamson	Ministry of Natural Resources	Thunder Bay
2022	Van Geene	Ministry of Natural Resources	Owen Sound
2023	Odell	Ministry of Natural Resources	Toronto
2026	Vine	Ministry of Natural Resources	Bancroft
2200	Adams	Napanee Region Conservation Authorit	Napanee
2201	Bonnis	Nickel District Conservation Authori	Sudbury
2202	Taylor	Essex Region Conservation Authority	Essex
2203	D'Amario	Niagara Peninsula Conservation Autho	Allanburg
2204	Eaton	South Nation Conservation Authority	Berwich
2206	Goldt	Upper Thames River Conservation Auth	London
2208	Graves	Catfish Creek Conservation Authority	Aylmer
2209	Jarrett	Metrop. Toronto & Reg. Cons. Auth.	Downsview
2211	English	Cataraqui Region Conservation Author	Glenburnie
2212		Lake Simcoe Region Conservation Auth	Newmarket
2213	Code	Raisin Region Conservation Authority	Martintown
2217	Suke	Lakehead Region Conservation Authori	Thunder Bay

LIST OF HYDROMETRIC DATA USERS
RESPONDING TO QUESTIONNAIRE

2223	Reid	Rideau Valley Conservation Authority	Manotick
2228	Tufgar	Halton Region Conservation Authority	Milton
2229	Gourley	Credit Valley Conservation Authority	Meadowvale
2230	Beckett	North Bay Mattawa Conservation Auth.	North Bay
2233	Westman	Saugeen Valley Conservation Authorit	Hanover
2236	Hughes	St. Clair Region Conservation Auth.	Strathroy
2239	Taylor	Maitland Valley Conservation Authori	Wroxeter
2242	Pols	Mattagami Region Conservation Auth.	Timmins
2243		Crowe Valley Conservation Authority	Marmora
2244	Roth	Lower Thames Valley Conservation Aut	Chatham
2245	Rutherford	Ganaraska Region Conservation Author	Port Hope
2249	Leja	Nottawasaga Valley Conservation Auth	Angus
2251	Hayman	Kettle Creek Conservation Authority	St. Thomas
2252		Lower Trent Region Conservation Auth	Trenton
2253	Taylor	Moira River Conservation Authority	Belleville
2255	Schmidt	Prince Edward Region Conservation Au	Picton
2257	Yanni	Sault Ste. Marie Region Conserv. Aut	Sault Ste. Marie
2261	Hill	Grey Sauble Conservation Authority	Owen Sound
2500	Logan	Ontario Ministry of Environment	Toronto
2501	Onderdonk	Ontario Ministry of Environment	Toronto
2502	Scott	Ontario Ministry of Environment	Toronto
2504	Dillon	Ontario Ministry of Environment	Dorset
2510	Roy	Ontario Ministry of Environment	Sudbury
2511	Vander Wal	Ontario Ministry of Environment	Thunder Bay
2512	German	Ontario Ministry of Environment	Kinston
2514	Irwin	Ontario Ministry of Environment	Hamilton
2800	Lane	Min. of Transportation & Communicati	Kingston
2800	Carter	Min. of Transportation & Communicati	Downsview
2800	Harris	Min. of Transportation & Communicati	Downsview
2801	Johnston	Ontario Ministry of Agriculture & Fo	Toronto
2801	Lang	Ontario Ministry of Agriculture & Fo	Cambridge
2801	Moore	Ontario Ministry of Agriculture & Fo	Lindsay
2809	Crawford	Ontario Ministry of Energy	Toronto
2901	Taylor	Ontario Hydro	Toronto
2902	Harris	Ontario Hydro	Toronto
2903	Doyle	Ontario Hydro	Toronto
2905	Walton	Ontario Hydro	Willowdale
2907	Davidson	Ontario Hydro	Barrie
2908	Graham	Ontario Hydro	North Bay
2909	Buitenhuis	Ontario Hydro	Thunder Bay
3000	Eichenbaum	City of Burlington	Burlington
3003	Balacko	Manitoba Health	Winnipeg
3004	Brown	Manitoba Environment	Winnipeg
3010	Manley	Public Utilities Commission	Peterborough
3500	Watt	Queens University	Kingston
3501	Bardecki	Ryerson Polytechnical Institute	Toronto
3502	Patry, P.Eng.	McMaster University	Hamilton
3502	Kramer	McMaster University	Hamilton
3503	McGinn	Brandon University	Brandon
3506	Adams	University of Toronto	Toronto
3506	Cifarelli	University of Toronto	Toronto
3507	Barton	Royal Military College	Kingston

LIST OF HYDROMETRIC DATA USERS
RESPONDING TO QUESTIONNAIRE

3510	Davis	University of Western Ontario	London
3510	Luckman	University of Western Ontario	London
3511	Dickinson	University of Guelph	Guelph
3512	Flosznik	York University	Downsview
3512	Leith	York University	Downsview
3512	Roulet	York University	Downsview
3513	Solomon	University of Waterloo	Waterloo
3513	Gardner	University of Waterloo	Waterloo
3513	McBean	University of Waterloo	Waterloo
3515	Johnson	University of Ottawa	Ottawa
3515	Lagarec	University of Ottawa	Ottawa
3515	Adamowski	University of Ottawa	Ottawa
3524	Tinkler	Brock University	St. Catharines
3527	Vandall	University of Windsor	Windsor
3531	Subins	Wilfrid Laurier University	Waterloo
3536	Watts	Sir Sandford Fleming College	Lindsay
3549	Drinkwater	Bedford Institute	Dartmouth
3550	Madramootoo	MacDonald College of McGill Universi	Ste. Anne DeBelle
4001	Kirchhefer	S.A. Kirchhefer Limited	Sudbury
4002	Firlotte, P.Eng.	Golder Associates	Mississauga
4005	Conetta, P.Eng.	MacLaren Plansearch Inc.	Toronto
4006	Paine	J.D. Paine Engineering Inc.	Kingston
4007	Buckrell	Proctor & Redfern Ltd.	Thunder Bay
4012	Belore, P.Eng.	Cumming - Cockburn & Associates Ltd.	Willowdale
4014	Concessi, P.Eng.	M.M. Dillon Ltd.	Willowdale
4014	Lorant, P.Eng.	M.M. Dillon Limited	Willowdale
4015	Kitchen, Ph.D.	Ecoplans Ltd.	Waterloo
4016	Slaughter	Gamsby and Manerow	Owen Sound
4017	Bishop	Marshall Macklin Monaghan Limited	Don Mills
4018	Anderson	B.M. Ross & Associates Ltd.	Goderich
4023	Bowa	Oliver Mangione McCalla	Nepean
4027	Chow	R.E. Winter & Associates Ltd.	Mississauga
4028	Moore, P.Eng.	Philips Planning & Engineering Ltd.	Burlington
4033	Elliott	D.F. Elliott Consulting Engineers Lt	New Liskeard
4035	Gibson	Barker Terp Gibson Limited	Don Mills
4038	Gorrie	Paragon Engineering Limited	Kitchener
4039	Gupta	G.M. Sernas & Associates Ltd.	Toronto
4040	Harsch	K. Smart Associates	Kitchener
4042	Mereu	Conestoga-Rovers & Associates Ltd.	Waterloo
4044	Johansen	F.J. Reinders & Assoc. Canada Ltd.	Brampton
4048	McNalty	Ainley and Associates Limited	Collingwood
4049	Marucelí	Totten Sims Hubicki Associates	Cobourg
4052	Ng	Walter Fedy McCarger Hachborn	Kitchener
4055	Rohacek	Reid and Associates Limited	Barrie
4061	Palmer	Gore & Storrie Ltd.	Toronto
4062	Walters	Giffels Associates Limited	Rexdale
4063	Wiebe	J. Bryon Wiebe Ltd.	Simcoe
4064	Yaeger	Delcan DeLeuw Cather Canada Ltd.	City of North Yor
4065	Judge	Acres International Limited	Niagara Falls
4065	Hill	Acres International Limited	Niagara Falls
4070	Rattie	ESSA Ltd.	Toronto
4071	Hansen	Ducks Unlimited	Barrie

LIST OF HYDROMETRIC DATA USERS
RESPONDING TO QUESTIONNAIRE

4074	Yee	Hatch Assoc.	Toront
4077	Lishman	Kostuch Engineering Ltd.	Gloucester
4083	James	Computational Hydraulics Inc.	Markham
4084	Osmond	Gartner Lee Assoc. Ltd.	Markham
4090	Stidwill	Stidwill & Assoc. Ltd.	Cornwall
4091	Kolomeychuk	Environmental Applications Group	Willowdale
4093		W.F. Baird & Assoc.	Ottawa
4100	De Carvalho, P.E	R.J. Burnside & Associates Ltd.	Orangeville
4108	Kresin, P.Eng.	Kresin Engineering & Planning Ltd.	Sault Ste. Marie
4110	Sutherland, P.En	Monteith & Sutherland Limited	Sarnia
4112	Fee	J.L. Richards & Associates Ltd.	Ottawa
4114	Denovan, P.Eng.	Shawinigan Intec Inc.	Toronto
4117	Bates	Galt Energy Systems Ltd.	Cambridge
4120	Mullerbeck	Albery Pullerits Dickson Swan Wooste	Don Mills
4121	Robertson	Teck Corporation	Vancouver
4122	Fuhrmann	SNC, W.P. London & Assoc.	Niagara Falls
4123	Graham	J.E. Hanna Associates	Pickering
4124	McVey	McVey Engineering	Niagara Falls
4127	Bonsteel	Pollutech Ltd.	Oakville
4128	Lackey	Triton Engineering Services Ltd.	Orangeville
4131	Glazier	W.R. Walker Engineering Inc.	Sault Ste. Marie
4140	Green	Conservation Management Systems	Waterloo
4602	Boals	Hydrotech Consulting Services	Orleans
4604	Clark		Ottawa
4607	Owen		Ottawa
4611	Trovak		Kitchener
4618	Kuiper		Brantford
4800	Agnew		Thornhill
4801	Bolger	Inco Environmental Control Dept.	Copper Cliff
4802	Corning	Centre Wellington DHS	Fergus
4803	Denning	Lambton Industrial Society	Sarnia
4805	Taylor	Polar Gas Project	Toronto
4807	Martin	Willis Cunliffe Tait Delcan	Ottawa
4808	Weltz, P.Eng.	Armbro Materials & Construction Ltd.	Brampton
4809	Reinsborough	Abitibi-Price Inc.	Mississauga
4810		Renfrew Hydro	Renfrew
4811	Seif	PetroCanada	Don Mills
4813	Symington	Great Lakes Power Ltd.	Sault Ste. Marie
4814	Vivyurka	Rio Algom Ltd.	Elliot Lake
4815	Adam	Interdisciplinary Systems Ltd.	Winnipeg
4816	Naish	Domtar Research	Seneville
4822	Simser	Royal Botanical Gardens	Hamilton
4823	Lister	Royal Ontario Museum	Toronto
4825	Jones	MIE Marine Ltd.	Toronto
4829	Childs	Bolter, Parish, Trimble Ltd.	Edmonton
4830	Copland	C E D S I	Mississauga
4901	Todd	U.S. Department of the Army	Chicago
4902	Wilshaw	U.S. Department of the Army	Detroit
4905	Croley II	U.S. Department of Commerce	Ann Arbor